Revista Habanera de Ciencias Médicas

YEAR 2021
20(3) MAY-JUNE
ISSN 1729-519X

ecimed

SURGICAL SCIENCES

ORIGINAL ARTICLE

Comparison of results of Conventional and Uniportal Video-Assisted Thoracic Surgery in the National Institute of Oncology and Radiobiology

Comparación de resultados de la Cirugía Torácica Convencional y la Uniportal en el Instituto Nacional de Oncología y Radiobiología

Juan Carlos Collado Falcón[1*], Claudia Suárez Rodríguez[2], Mariano Valverde Ferrás[3], Juan Carlos Collado Otero[4], Ramón de Jesús Ropero Toirac[2,4], Mircea Betancourt Cabezas[2,4]

[1]Policlínico Universitario Héroes del Moncada". La Habana, Cuba.
[2]Universidad de Ciencias Médicas de La Habana. Facultad de Ciencias Médicas "Manuel Fajardo". La Habana, Cuba.
[3]Hospital Docente Clínico Quirúrgico "Manuel Fajardo". La Habana, Cuba.
[4]Instituto Nacional de Oncología y Radiobiología. La Habana, Cuba.

***Corresponding author:** icolladofalcn@yahoo.com

Cite this article as
Collado-Falcón JC, Suárez-Rodríguez C, Valverde-Ferrás M, Collado-Otero JC, Ropero-Toirac RJ, Betancourt-Cabezas M. Comparison of results of Conventional and Uniportal Video-Assisted Thoracic Surgery in the National Institute of Oncology and Radiobiology. Rev haban cienc méd [Internet]. 2021 [citado:];21(3):e3235. Disponible en: http://www.revhabanera.sld.cu/index.php/rhab/article/view/3235

Received: March 19th, 2020
Approved: January 30th, 2021

ABSTRACT

Introduction: Single-port Video Assisted Thoracic Surgery (Uniportal VATS) has currently become one of the most commonly used approaches for lung resections in many Thoracic Surgery Centers around the world. In Cuba, its introduction is quite recent and it is still in its initial phase.

Objective: To compare the results obtained by open thoracic surgery and Uniportal VATS in patients who underwent surgery in the National Institute of Oncology and Radiobiology of Havana (INOR) from January 2016 to April 2017.

Material and Methods: An observational descriptive longitudinal retrospective study was conducted in 60 patients who underwent Thoracic Surgery in the INOR during 2016 – April 2017.

Results: A total of 24 patients were operated through Uniportal VATS and 36 underwent thoracotomy. The lesions predominantly affected the right side and lobectomy was the most performed surgical procedure. Stages IA and IB predominated. Most of the procedures were carried out in 3 hours or less, 8 cases were converted and 13 suffered from complications. The average postoperative length of stay in hospital for patients who underwent Uniportal VATS was reduced compared to those who underwent open thoracotomy.

Conclusions: Uniportal VATS is characterized by being a safe procedure with few complications and great versatility. It improves postoperative recovery of patients and accelerates their return to daily life activities.

Keywords:
Video-assisted thoracic surgery, thoracotomy approach, Uniportal, lung resection.

RESUMEN

Introducción: La cirugía torácica videoasistida por un solo puerto (Uniportal VATS) se ha convertido hoy en uno de los abordajes más utilizados para resecciones pulmonares en muchos centros de cirugía torácica del mundo; en Cuba su introducción es bastante reciente y todavía se encuentra en fase inicial.

Objetivo: Comparar los resultados obtenidos por cirugía torácica abierta y Uniportal VATS en pacientes intervenidos en el Instituto Nacional de Oncología y Radiobiología de La Habana (INOR) durante enero de 2016 a abril de 2017.

Material y Métodos: Estudio observacional descriptivo de corte longitudinal retrospectivo con 60 pacientes atendidos en el INOR durante enero de 2016 a abril de 2017 a los cuales se les realizó cirugía torácica.

Resultados: Veinticuatro pacientes fueron operados por Uniportal VATS y 36 a través de la toracotomía, primaron las lesiones del lado derecho, el procedimiento más realizado fue lobectomía. Los estadíos predominantes fueron IA y IB, la mayoría de los procedimientos fue realizada en tres horas o menos, 8 casos se convirtieron, 13 sufrieron complicaciones. La estadía media de los pacientes tratados con uniportal VATS fue menor que los que recibieron la toracotomía abierta.

Conclusiones: El abordaje Uniportal se caracterizó por ser seguro, tener una gran versatilidad, pocas complicaciones y por mejorar la recuperación postquirúrgica del paciente y acelerar su reincorporación a las actividades de la vida cotidiana.

Palabras Claves:
Cirugía torácica, video-asistida, toracotomía, uniportal, resección pulmonar.

INTRODUCTION

Video-assisted Thoracic Surgery (VATS) is a minimally invasive therapeutic option that allows access and treatment of thoracic organs through small incisions (ports) of a few centimeters each, through which a video-thoracoscope and the rest of the instruments needed for the procedure are inserted and, in case of resection, the surgical piece is removed. Uniportal video-assisted thoracic surgery is the newest modality of VATS where only one incision is required.[1,2,3,4]

The Thoracic Surgery Group of the National Institute of Oncology and Radiobiology of Havana (INOR for its acronym in Spanish) is very experienced in this type of surgery which includes the traditional approach and the minimally invasive one. At the beginning of the 21st century, several procedures were conducted using the 2-port and 3-port techniques, however, this was an intermittent practice until 2016 when Dr. Diego González Rivas introduced the Uniportal technique by operating on Cuban patients in INOR, which aided in the resumption of VATS and in its development in the country. The Thoracic Surgery Group of INOR has played an important role in the introduction and development of this technique in Cuba.

Uniportal surgery is being considered a standard procedure in many places of the world due to its advantages for patients such as shorter hospital stay, earlier return to daily life activities, less complications and disabilities, and less postoperative pain.[1,2,3,5,6,7,8] It also offers multiple therapeutic options such as non-intubated surgery, which besides testing the experience and ability of anesthesiologists, reduces even more the invasiveness of the surgical act, thus improving the patient's experience.[9] The use of Uniportal surgery is very recent in the national framework where the traditional open surgery is still predominant; therefore, there are no available data or published information about this topic in Cuba.

The **objective** of this study is to compare the results obtained by using open thoracic surgery and Uniportal VATS approaches in patients who underwent surgery in the INOR between January 2016 and April 2017.

MATERIAL AND METHODS

An observational descriptive longitudinal retrospective study was conducted in 60 patients who underwent thoracic surgery in the INOR during 2016 – April 2017.

A consecutive, opinatic sample was selected in the previously indicated period of time in accordance with the inclusion and exclusion criteria; a total of 60 patients were selected, 36 patients were operated by using the Open Traditional Approach (OTA) and 24 by using Uniportal VATS.

Patients over 18 years of age that underwent Thoracic Surgery in INOR between January 2016 and April 2017 and whose clinical records provided all the necessary data for research were included in the study.

Patients under 18 years of age and those whose clinical records did not provide all the necessary data for research were excluded from the study.

The data were directly obtained from the patient's clinical records. The variables studied included: age (in years), gender (according to biological gender), patient's history (smoking, personal history of cancer, family history of cancer), main complaint (cough, hemoptysis, chest pain, paraneoplastic symptoms), clinical stage (IA, IB, IIA, IIB, IIIA, IIIB, IV, pulmonary metastasis and benign tumor), type of surgery (lobectomy, bilobectomy, pneumonectomy, costo-pleuro-lobectomy, atypical resection, exploratory surgery and pleural biopsy), histological diagnosis (adenocarcinoma, squamous cell carcinoma, benign lesions, others), surgical time (less than 1h, between 1 and 2h, between 2 and 3h, between 3 and 4h, more than 4h) postoperative complications (of the airways, of the pleura, cardiovascular, of the surgical site, fractures), postoperative time in days (1, 2, 3, 4, 5 and more than 5 days).

The eighth edition of the TNM classification of lung cancer was used for staging.

Descriptive statistical methods such as absolute frequency, percentages and means were used. For the statistical processing, Chi-square test was applied in contingency tables; Student t test was used for the comparison of the mean ages and Kolmogorov-Smirnov test was used to estimate the difference between medians of time. A significance level of $p \leq 0.05$ was assumed. SPSS version 21.0 statistical package and Microsoft Word were used to create tables and graphs as well as for the elaboration of the final report.

This research was approved by the Research Ethics Committee of the INOR. Every patient was given information about the surgical procedure, its risks and complications; patients' informed consent was obtained and signed prior to the surgical intervention. Confidentiality norms were implemented to protect the identity and data of the subjects.

RESULTS

The average age of the operated patients was 62 years, with a higher frequency in patients aged 60-69 years. The average age of patients operated by using Uniportal VATS approach was 64 years, while that of those operated by OTA was 59 years. This difference was not statistically significant (p=0,062). A predominance of males over females was also observed. (Table 1)

Among the patients included in the study, 88,3% were smokers. There was a statistically significant association between smoking and the frequency of patients with lung cancer (p=0,0000). Moreover, 20% of the patients had a Personal History of cancer (PH-C) whereas 30% had a Family History of cancer (FH-C). (Table 1)

The most common main complaint was cough, which occurred in 90% of the patients. It was followed by chest pain (31,7%), general symptoms (fever, asthenia, anorexia and/or weight loss) (23,3%), and hemoptysis (11,7%). Several patients had two or more of the previously mentioned symptoms at the same time. **(Table 1).**

Table 1: Distribution of patients according to general data, patient history and main complaint

Variables	No.	%
Age		
40 – 49	8	13,3
50 – 59	14	23,4
60 – 69	27	45
70 and more	11	18,3
Mean ± SD (years) = 61,5 ± 9.6		
Gender		
Female	21	35
Male	39	65
Patient History		
Smoking*	53	88,3
PH-C	12	20
FH-C	18	30
Main Complaint		
Cough	54	90
Hemoptysis	7	11,7
Chest pain	19	31,7
General Symptoms	14	23,3

*Chi-square=35,3 p=0,0000 GL=1

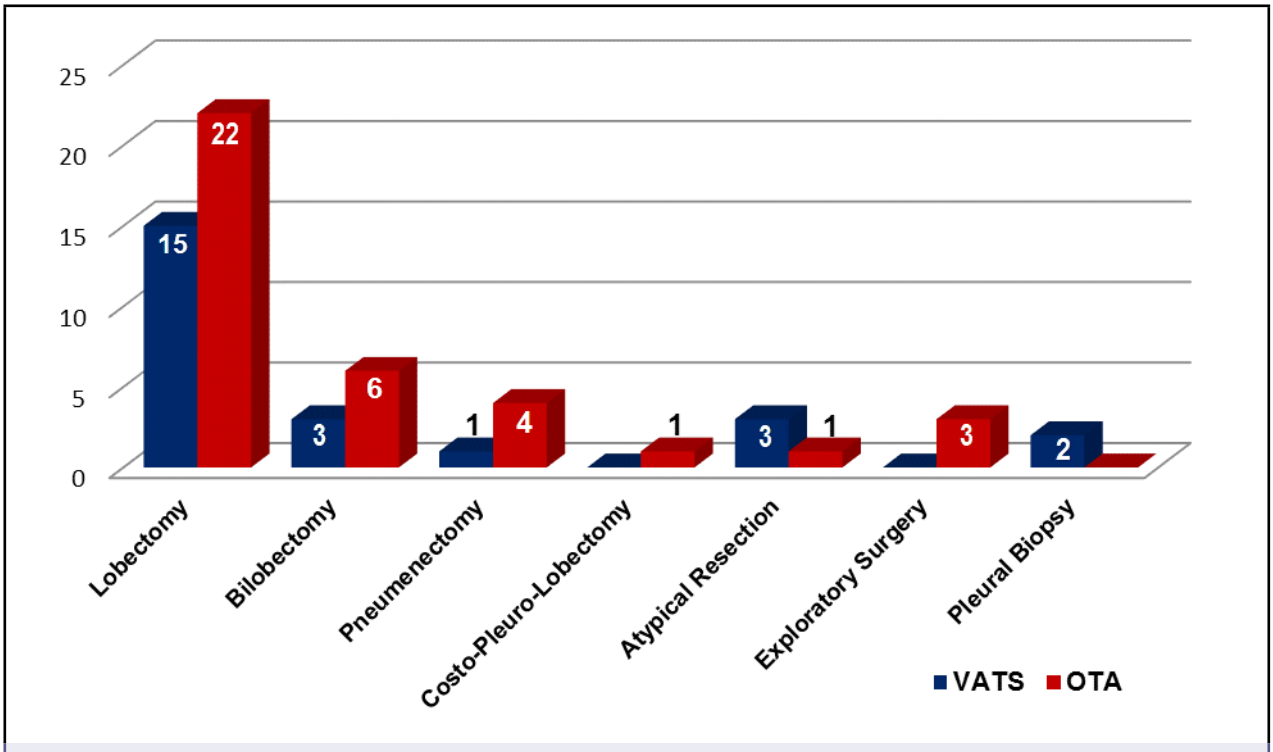
The OTA slightly predominated over the Uniportal VATS. In both cases, more lesions in the right side were treated (a total of 39, for 65%) than those in the left side (a total of 31, for 35%). Upper lobes were the most affected ones (38, for 63,3%). There was not a statistically significant association (p=0,655). **(Table 2).**

Table 2: Distribution of patients according to the location of the lesion and type of approach used

Location of the lesions	**Type of Approach**									
	Uniportal VATS				Total	**OTA**				**Total**
	Right Lung		**Left Lung**			**Right Lung**		**Left Lung**		
Lobe	**No.**	**%**	**No.**	**%**		**No.**	**%**	**No.**	**%**	
Upper	9	15	5	8,3	14	17	28,3	7	11,7	24
Middle	1	1,7	0	0	1	1	1,7	0	0	1
Lower	3	5	6	10	9	8	13,3	3	5	11
Total	13	21,7	11	18,3	24	26	43,3	10	16,7	36

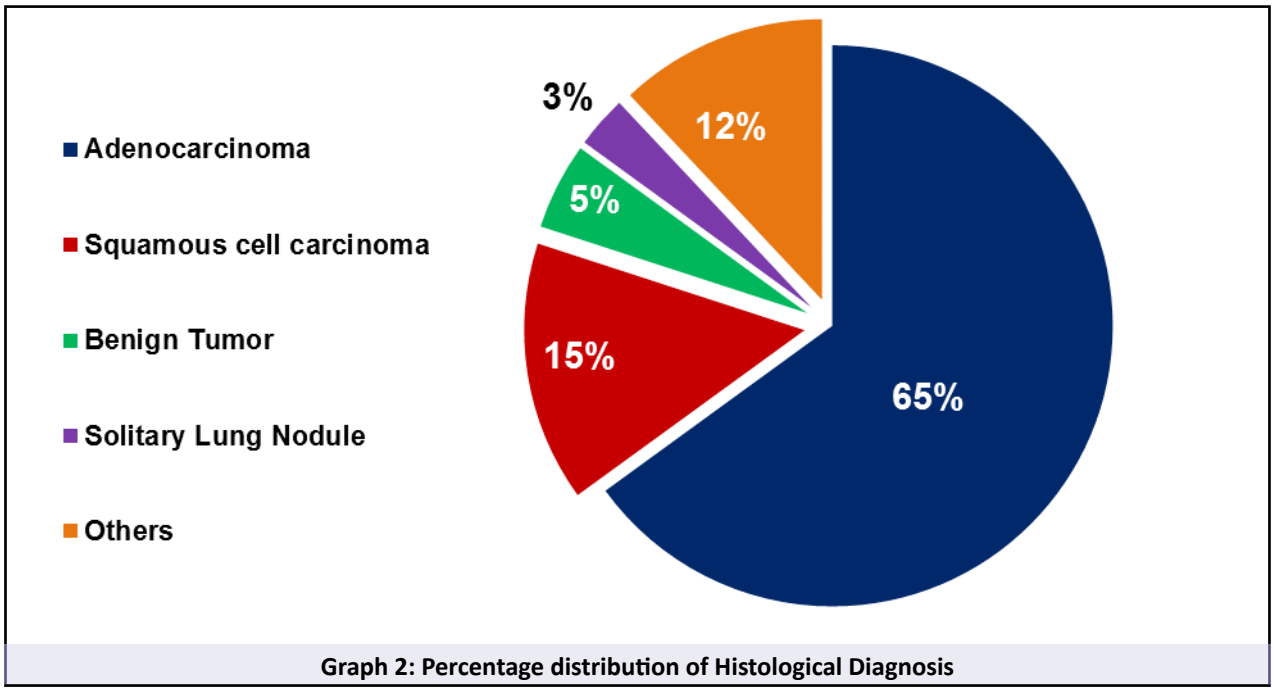
Chi-square= 4,15 p=0,655 NS

Lobectomy was the most common procedure performed according to the affected lobe: 25% were performed by Uniportal VATS and 36,6% by OTA for a total of 61,6%, followed by bilobectomies: 5% were performed by Uniportal VATS and 10% by OTA, for a total of 15%; and pneumenectomies:1,7% were performed by Uniportal VATS and 6,7% by OTA, for a total of 8,4%. **(Graph 1).**



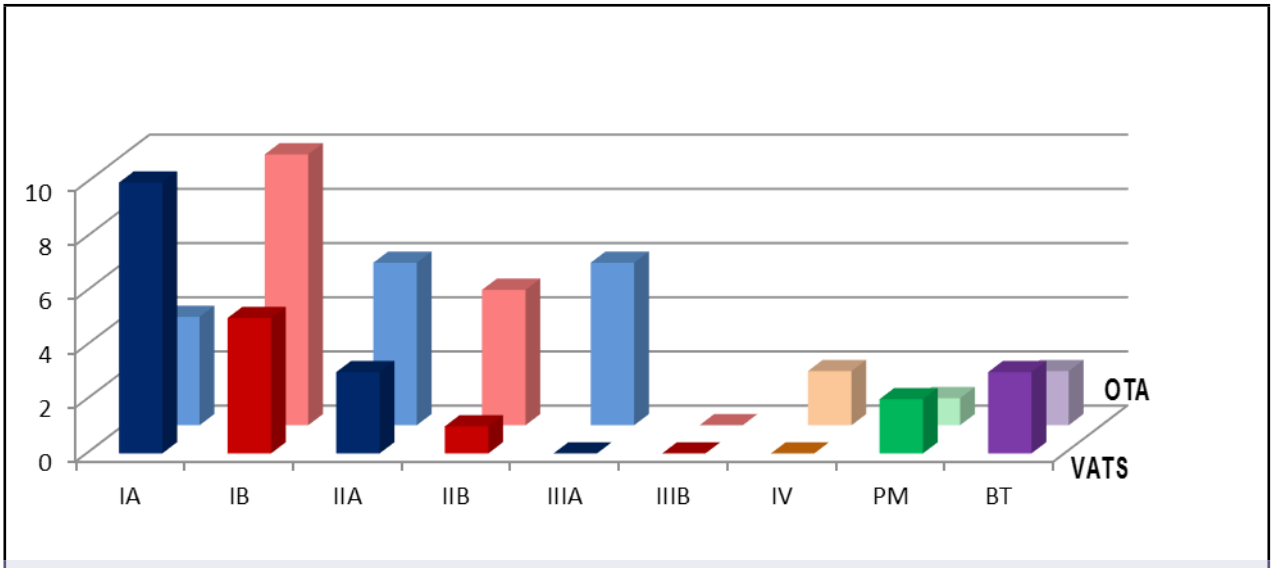
Graph 1: Procedures performed according to the approach used.

Adenocarcinoma was identified as the predominant type of histological diagnosis (65%). The rest of the histological types were much less frequent among the patients included in the study. **(Graph 2).**



Graph 2: Percentage distribution of Histological Diagnosis

The predominant clinical stages were IA and IB (23,4% and 25%, respectively). Of the lesions removed 5 were benign; therefore, they were not appropriate for staging. **(Graph 3).**



Graph 3: Distribution of patients according to the clinical stage in which lung cancer was diagnosed
PM: Pulmonary Metastasis **BT:** Benign Tumor

All the procedures performed by OTA approach were completed in less than 3 hours. Regarding Uniportal VATS approach, the surgery took longer than 3 hours in 7 patients. The procedures performed by OTA were completed in less time than those procedures performed by Uniportal VATS. The average surgical time was 2 hours and 15 minutes. There was a statistically significant difference between the surgical time in both approaches. (p=0.0010) **(Table 3).**

Of the 24 procedures performed by using Uniportal VATS, 8 had to be converted and finished with OTA. Only 13 patients suffered complications (21,7%). The most common ones were those of the airways and the surgical site (5% in each case). Most of the complications occurred in patients who underwent OTA (9 for a 69,2% of the total of complications).

Table 3: Distribution of patients according to the surgical time and surgical approach

Surgical Time	Uniportal VATS	%	OTA	%	Total	%
x ≤ 1	5	8,3	6	10	11	18,3
1 < x ≤ 2	5	10	25	41,7	31	51,7
2 < x ≤ 3	5	10	5	8,3	11	18,3
3 < x ≤ 4	2	3,4	0	0	2	3,4
x > 4	5	8,3	0	0	5	8,3
Total	24	40	36	60	60	100

Chi-square= 18,4 p=0,0010

The median postoperative time was 2,5 days [95% CI (2-3)] in patients who underwent Uniportal VATS, while in those in whom OTA was performed, the median time was 4 days [95% CI (3-4)]; there was a statistically significant difference between medians (Z=1,99 p=0,001). According to time intervals, half of the patients who underwent Uniportal VATS were discharged within 2-3 days after the surgery (a total of 12 patients, representing 50%) while most of the patients who underwent OTA stayed in hospital for 5 days or more after the surgery (a total of 27 patients, for a 75%). This difference is statistically significant (0=0,0001). **(Table 4).**

Table 4: Distribution of patients according to postoperative time and the approach used

Postoperative time	Uniportal VATS		OTA		Total	
	No.	%	No.	%	No.	%
2	3	5	0	0	3	5
3	9	15	1	1,7	10	16,7
4	7	11,6	8	13,3	15	24,9
5	4	6,7	15	25	19	31,7
More than 5 days	1	1,7	12	20	13	21,7
Total	24	40	36	60	60	100

Chi-square= 24.6 p=0.0001

DISCUSSION

There were more male than female patients in the selected sample and a predominance of ages between 60 and 69 years. The youngest patient included in the study was 40 years old at the moment of the surgery while the oldest one was 81 years old. The average age of the patients who were operated by Uniportal VATS was 64 years, while that in whom OTA was performed was 59 years; the global average age was approximately 62 years of age. This demonstrates that age is not a limitation for performing Uniportal VATS. The mean age of patients who underwent Uniportal VATS is very similar to that presented in two comparative studies carried out in Spain (65 years). In this study, there was a marked predominance of male patients (74%).[10] The data obtained are also similar to those presented in some studies carried out in Canada and Argentina which reported average ages of 63 and 59 years, respectively. There was a predominance of male patients.[11,12]

Additionally, 88,3% of patients included in the study were smokers. These numbers are much higher than those reported by other authors such as González Rivas et al. who stated that 61% of the patients included in a study published in 2014 had a history of smoking. In a study carried out in Asturias in 2014, Aragon et al. reported only 23% of patients with a history of smoking.[10,13] This difference is due to the fact that Cuba is a producer and a large consumer of tobacco as well as to the early age in which people begin to smoke in Cuba, evidencing the association between smoking and the appearance of cancer of the respiratory organs.[14,15,16]

Around 20% of the patients included in this study had had other types of cancer. These data are very similar to those reported by Spanish authors (23,5 %) and lower than those presented by German authors (37 %).[10,17] Also 30% of the patients included in this study had a Family History of Cancer. These findings are consistent with the widespread belief that, although hereditary factors play an important role in the development of the disease, the changes at genetic and molecular levels that occur in lung cancer patients are mostly due to the action of exogenous factors like the exposure to industrial chemicals as well as the smoking habit.[18] It is estimated that the risk of developing lung cancer is ten times higher for smokers than for those people who are not exposed to tobacco.[10,17,18,19]

Cough was the most common main complaint of the patients included in the study. It is a common non-specific symptom in many respiratory diseases that most smokers have. Therefore, it is very important to pay special attention to patients who present chronic cough or a cough accompanied by other clinical features such as chest pain, dyspnea, hemoptysis and general symptoms (fever, weakness, anorexia and important weight loss in a short period of time), mainly in the case of patients with a history of smoking. Only 5 (9 %) of the patients with cough as the main complaint were not smokers. Several patients reported two or more of the previously mentioned symptoms at the same time. Other studies reported similar main complaints; however, it is important to mention that, in many cases, the disease was diagnosed in a subclinical stage (casual diagnosis).[10,17,19]

Lesions in the right lung predominated over those in the left lung, upper lobe lesions were predominant as well. There was not a big difference with regard to the approach used to treat lesions of the lower and middle lobes although OTA was more generally used than Uniportal VATS to treat the lesions of the upper lobe, mainly those in the right upper lobe; however, it does not mean that the location of the lesion is a limitation for the use of Uniportal VATS. The existing equivalence in the proportion in which both approaches are used demonstrates the development experienced by Uniportal VATS approach since its appearance. At the beginning, it was used only to perform lower lobectomies, however, the location of the lesion is not a limitation at the present time. Moreover, the use of Uniportal VATS approach does not interfere with the performance of appropriate oncological surgeries. On the contrary, with this approach, the structures can be magnified, allowing a better delimitation of the lesion and an adequate resection of lymph nodes, as needed in each case.[10,17,19,20,21,22,23]

According to the affected lobe, lobectomy was the most common procedure performed, followed by bilobectomy and pneumonectomy. One costo-pleuro-lobectomy was performed in a patient with Pancoast tumor. Both pleural biopsies as well as 3 of the 4 atypical resections were performed by Uniportal VATS. These findings coincide with those reported by international authors and prove that Uniportal VATS can be used for therapeutic and diagnostic aims regardless of the surgical procedure performed in each case.[8,11,19,21,23] Uniportal VATS can be used for more than pulmonary resections; the treatment of pneumothorax, thymectomies and even costo-pleuro-lobectomies and cardiovascular surgery procedures can be carried out using this approach. It should be emphasized that Uniportal VATS still offers many unexplored options.[19,23]

The most common histological diagnosis in this study was adenocarcinoma, which coincides with national and international statistics.[8,10,18,22,23] Pulmonary metastasis of other primary tumors (1 osteosarcoma and 1 colon tumor) as well as other malignant tumors which were diagnosed in smaller numbers were grouped under the name “Others”.

The predominant clinical stage in which the disease was diagnosed in the patients included in this study was IB, followed by IA, IIA, IIB and IIIA. In 3 patients, the lesion removed was a pulmonary metastasis of a primary tumor. This demonstrates that Uniportal VATS can be used regardless of the clinical stage of the disease. Globally, the disease is mostly diagnosed in early stages. In Spain, 63% of the cases were diagnosed in stage IA[10,19]; in China, 48% of the cases were diagnosed in that same stage.[23] However, the figures presented in these results are higher than those obtained

in this study since only 23,4% of the patients were diagnosed as stage IA. On the other hand, a large number of patients were diagnosed in advanced stages of the disease in part due to the poor health culture in the population, the lack of regular medical check-ups and difficulties in the early diagnosis of the disease at the Primary Care Level and its referral to the different levels of care; that is, due to a poor screening. These data are considerably higher compared with international data that reveal that most of the patients are diagnosed in early stages of the disease, which positively influences the response to treatment and survival.[10,17,18,19,23] Surgical treatment is not indicated in those cases in IIIB and IV stages of the disease, except for rare cases. Of the patients included in the study, 2 had metastasis in other locations at the moment of the diagnosis and therefore they were in stage IV. Of the lesions removed, 5 were benign.

Most of the surgical procedures were completed in 3 hours or less (88,4%) with an average surgical time of 2 hours and 15 minutes; however, there were differences between the 2 approaches. When OTA was performed, the average surgical time was 2 hours and 10 minutes while in the case Uniportal VATS, the average surgical time was about 2 hours and 50 minutes, demonstrating that even though OTA is faster, the difference between the 2 approaches is not very significant. The surgical time of 2 hours and 50 minutes required by Uniportal VATS is in relation to the data published by other healthcare centers around the world during the learning curve for this approach (between 2 and 3 hours).[17,19,20,21] Certain technical difficulties, problems with the instruments and operating room equipment like the thoracoscope and the aspiration machine as well as the lack of disposable materials such as clips and mechanical suture charges were against the duration of the procedure. The learning curve for Uniportal VATS is very similar to that using the 2-port and 3-port techniques, established in 80 cases.[10,21]

Approximately one third of the cases that started with the Uniportal VATS approach had to be converted and finished with OTA. This is mainly due to the fact that at the moment these surgeries were carried out, the learning curve for Uniportal VATS was still in a very early stage. In the following months, the number of conversions decreased in accordance to the learning curve. Some of the reasons that motivated the conversions include vascular lesions, inability to maintain an adequate oxygen saturation level as well as to keep the lung collapsed, and inadequate selection of the cases that were operated by using Uniportal VATS because selection criteria are not clearly defined for the technique in Cuba. It is estimated that the conversion rate depends on the level of complexity of each particular case and the place of the learning curve in which the surgeon is; it varies from 2% to 23%,[10] which is lower than the conversion rate obtained in this study. Several authors reported much lower conversion rates than the one informed in this study.[10,24]

A total of 13 patients included in this study suffered postoperative complications (21,7%). Complications of the airways and the surgical site were the most common. Only 4 of the 13 complications occurred in patients operated by using Uniportal VATS approach (3 of them were minor complications), the rest of the complications occurred in patients who were operated by using OTA approach. These findings show that Uniportal VATS is safer than OTA for the patient and that it is associated with a smaller number of complications. It confirms that Uniportal VATS has to be taken into consideration when deciding which approach to use. In this study, the complication rate in those patients who underwent Uniportal VATS was lower than the rates reported by authors worldwide.[10,17,19,20,21,23]

The postoperative time (in days) for patients who were operated by Uniportal VATS was substantially shorter than that experienced by patients who were operated by OTA. The average postoperative period was about 5 days, however, there were differences between the 2 approaches. In the cases operated by Uniportal VATS, the patients were discharged within 3 days after the surgery, exactly the same time reported by Chinese[23] and Spanish[10,19] authors in this stage of the learning curve. On the contrary, the patients operated by OTA stayed in hospital an average time of 5 to 6 days after the surgery. The patient who was discharged the earliest only stayed 2 days in the hospital after Uniportal VATS surgery, while the patient who stayed the longest, spent 25 days after pneumonectomy was performed with OTA. The shorter postoperative hospital stays of patients who underwent Uniportal VATS surgery can be explained by different factors, for example, a smaller incision results in a substantial pain reduction since there is less tissue damage than in those cases operated by OTA. Likewise, the risk of costal fracture and injury to vascular-nerve bundle is reduced, being less invasive; moreover, the risk of bleeding and surgical infections as well as the postoperative pain is greatly reduced. The use of analgesics is significantly decreased and the patient is able to move normally in a shorter period of time, which justifies the fast discharge and allows the patients to resume their daily life activities much sooner.[10,19,23,24,25]

A ***limitation*** of this study is that, as it is an observational and descriptive study of cases operated in a specific period of time, no randomization to surgical treatment was performed, nor the variables could be controlled to decrease possible biases.

CONCLUSIONS

Uniportal VATS was implemented successfully in the National Institute of Oncology and Radiobiology of Havana; the results obtained were similar to those reported by other authors all over the world. Uniportal VATS demonstrated to be safe and versatile with few complications, a better postoperative recovery and a faster reintegration of the patients to their daily life activities.

RECOMMENDATIONS

We recommend to conduct a controlled research that evaluates the risk/benefit rate of both surgical approaches.

REFERENCES

1. González Rivas D. Uniportal thoracoscopic surgery: from medical thoracoscopy to non-intubated uniportal video-assisted major pulmonary resections; Annals of Cardiothoracic Surgery. Ann Cardiothorac Surg 2016;5(2):85-91
1. Sihoe ADL. Uniportal video-assisted thoracoscopic lobectomy. Ann Cardiothorac Surgn2016;5(2):133-144. Doi: 10.2037/acs.2016.03.14.
2. Hirai K, Takeuchi S, Usuda J. Single-incision thoracoscopic surgery and conventional video-assisted thoracoscopic surgery: a retrospective comparative study of perioperative clinical outcomes. Eur JCardiothorac Surg 2016;49:i37–i41.
3. Rodríguez Panadero F. "La toracoscopía hoy: indicaciones y procedimiento"; archivo de Bronconeumología 2004; 40,6: 49-54.
4. Hernández Gutiérrez JM, Nodal Ortega J, Martínez Alfonso MA, Torres Peña R, Sarduy Paneque M. "Cirugía torácica videoasistida. Aplicaciones y perspectivas" Neumología y Cirugía torácica, july-september de 2012;71(3):212-218.
5. Passera E, Rocco G. From full thoracotomy to uniportal video-assisted thoracic surgery: lessons learned. J Vis Surg 2017;3:36. Availabe in: http://dx.doi.org/10.21037/jovs.2017.01.14
6. Nachira D, Meacci E, Ismail M, González Rivas D, Margaritora S. Why to change from multiportal to uniportal VATS? Video-assist Thorac Surg 2018. Available in: http://dx.doi.org/10.21037/vats.2018.04.01
7. Wang l, Liu D, Lu J, Zhang S, Yang X. The feasibility and advantage of uniportal video-assisted thoracoscopic surgery (VATS) in pulmonary lobectomy. BMC Cancer (2017) 17:75. DOI 10.1186/s12885-017-3069-z
8. Elkhayat H, González Rivas D. Nonintubated uniportal video-assisted thoracoscopic surgery. J Thorac Dis 2019;11(Suppl 3):S220-S222. doi: 10.21037/ jtd.2019.02.05. Available in: http://dx.doi.org/10.21037/jtd.2019.02.05
9. González Rivas D, Fieira E, Delgado M, Méndez L, Fernández R, De la Torre M: "Is uniportal thoracoscopic surgery a feasible approach for advanced stages of non-small cell lung cáncer?" J Thorac Dis 2014;6(6):64-648. Doi: 10.3978/j.issn.2072-1439.2014.05.17. Available in: http://dx.doi.org/10.3978/j.issn.2072-1439.2014.05.17
10. Drevet G, Ugalde Figueroa P. Uniportal video-assisted thoracoscopic surgery: safety, efficacy and learning curve during the first 250 cases in Quebec, Canada. Ann Cardiothorac Surg 2016;5(2):100-106. doi: 10.21037/acs.2016.03.05. Available in: http://dx.doi.org/10.21037/acs.2016.03.05
11. Bondulich G, González Rivas D. Uniportal video-assisted thoracoscopic surgery, argentinian experience. J Vis Surg 2017;3:60. Available in: http://dx.doi.org/10.21037/jovs.2017.03.21
12. Aragón J, Pérez Méndez I: "From open surgery to Uniportal VATS: Asturias experience." J Thoracic Dis 2014; 6(S6):S644-S649. doi: 10.3978/j.issn.2072-1439.2014.08.53
13. Anuario Estadístico de Salud de 2017. La Habana: Ministerio de Salud Pública; 2018.
14. WHO global report on trends in prevalence of tobacco smoking 2000 – 2025; 2nd Edition. Geneva: World Health Organization; 2018.
15. Mena Cardoso A, Rodríguez Águila E, Ramos Hurtado I. "El hábito de fumar en la adolescencia". Acta médica del centro/ 2017;11(1). Available in: http://www.revactamedicacentro.sld.cu.
16. Mahmound I, Helming M, Swierzy M, Neudecker J, Ç Badakhshi H, González Rivas D, Rückert JC. "Uniportal VATS: the first German experience".J ThoracDis 2014. 9 de septiembre de 2014. Available in: http://dx.doi.org/10.3978/j.issn.2072-1439.2014.10.15
17. Kumar V, Abbas A, Aster J, Perkins Jz: Robbins basic pathology. 10th ed. New York: Elsevier; 2017.
18. Aragón J, Pérez Méndez I. "From open surgery to uniportal VATS: Asturias experience". J ThoracDis 2014. 21 de agosto de 2014. Available in: http://dx.doi.org/10.3978/j.issn.2072-1439.2014.08.53
19. González Rivas D, Fierita E, Delgado M, Méndez L, Fernández R, De la Torre M. "Evolving from conventional video-assisted thoracoscopic lobectomy to uniportal: The story behind the evolution". J ThoracDis 2014. 13 de agosto de 2014. Available in: http://dx.doi.org/10.3978/j.issn.2072-1439.2014.08.44
20. González Rivas D, Fierita E, Delgado M; Méndez L, Fernández R, De la Torre M. "Uniportal video assisted thoracoscopic lobectomy". 5 de julio de 2013. Available in: http://dx.doi.org/10.3978/j.issn.2072-1439.2013.07.30
21. Yong Zhu, Guo-Bing Xu, Cheng-Gang Lei, Jin-Bao Xie, Wei Zheng,Chun Chen. "Thoracic surgery: single-port video-assisted thoracoscopic lobectomy.". J ThoracDis 2014. 30 de mayo de 2015; Available in: http://dx.doi.org/10.3978/j.issn.2305-5839.2015.06.06

22. Yong Zhu, Guo-Bing Xu, Bin Zheng, Mingqiang Liang, Weidong Wu, Wei Zheng. Chun Chen. "Single-port video-assisted thoracoscopic surgery lung resection: Experiences in Fujiam Medical University Union Hospital". JThoracDis 2014.. J ThoracDis 2014 30 de mayo de 2015. Available in: http://dx.doi.org/10.3978/j.issn.2072-1439.2015.06.02
23. Abu Akar F, GonzálezRivas D, Ismail M, Deeb M, Reichenshtein Y, Hadas-Halpern I, Tauber R, Fink D. Uniportal video-assisted thoracic surgery: the Middle East experience. J Thorac Dis 2017;9(4):871-877. doi: 10.21037/jtd.2016.11.89. Available in: http://dx.doi.org/10.21037/jtd.2016.11.89
24. Passera E, Rocco G. From full thoracotomy to uniportal video-assisted thoracic surgery: lessons learned. J Vis Surg 2017;3:36. Available in: http://dx.doi.org/10.21037/jovs.2017.01.14
25. Reinersman JM, Passera E, Gaetano Rocco G. Overview of uniportal video-assisted thoracic surgery (VATS): past and present. Ann Cardiothorac Surg 2016;5(2):112-117. doi: 10.21037/acs.2016.03.08. Available in: http://dx.doi.org/10.21037/acs.2016.03.08

Conflict of Interest

The authors declare that there is not any conflict of interest.

Authorship Contribution

JCCF: Conception and design of the article; data collection; analysis and interpretation of collected data; writing of the manuscript; critical review of the manuscript; review of the final version of the manuscript.
CSR: Conception and design of the article; data collection; analysis and interpretation of collected data; writing of the manuscript; critical review of the manuscript; review of the final version of the manuscript.
MVF: Conception and design of the article; analysis and interpretation of collected data; writing of the manuscript; critical review of the manuscript; review of the final version of the manuscript.
JCCO: Data collection; analysis and interpretation of collected data; critical review of the manuscript; review of the final version of the manuscript.
RJRT: Analysis and interpretation of collected data; critical review of the manuscript; review of the final version of the manuscript.
MBC: Analysis and interpretation of collected data; critical review of the manuscript; review of the final version of the manuscript.

All authors participated in the discussion of the results; all of them have read, reviewed and approved the final version of article.