ORIGINAL ARTICLE
MINIMALLY INVASIVE SURGERY
http://dx.doi.org/10.1590/S1808-185120222201269159

THE ACADEMIC IMPACT OF THE SYMPOSIUM ON ENDOSCOPY AND MINIMALLY INVASIVE SPINE SURGERY OF THE MEXICAN ASSOCIATION OF SPINE SURGEONS – AMCICO

O IMPACTO ACADÊMICO DO SIMPÓSIO DE ENDOSCOPIA E CIRURGIA MINIMAMENTE INVASIVA DA COLUNA VERTEBRAL DA ASSOCIAÇÃO MEXICANA DE CIRURGIÕES DA COLUNA VERTEBRAL - AMCICO

EL IMPACTO ACADÉMICO DEL SIMPOSIO DE ENDOSCOPIA Y CIRUGÍA MINIMAMENTE INVASIVA DE COLUMNA DE LA ASOCIACIÓN MEXICANA DE CIRUJANOS DE COLUMNA – AMCICO

ALFONSO GARCIA[1], EULALIO ELIZALDE MARTÍNEZ[2], ILIANA MARGARITA GÓMEZ SILVA[3], JAVIER QUILLO-OLVERA[4], CESAR A. ALCÁNTARA CANSECO[5], MANUEL RODRIGUEZ GARCIA[6], SERGIO SORIANO SOLIS[6], STEFAN HELLINGER[7], PAUL HOULE[8], RAYMOND GARDOCKI[9], ALEJANDRO SHARID SUAREZ LUBIA[10], KAI-UWE LEWANDROWSKI[11,12,13,14,15,16]

1. Hospital Angeles Tijuana, Espalda Saludable, Tijuana, B.C., México.
2. UMAE "Dr. Victorio de la Fuente Narvaez", Orthopedic Hospital, CDMX, Mexico.
3. Hospital Ángeles Universidad, CDMX, México.
4. The Brain and Spine Care, Minimally Invasive Spine Surgery Group, Santiago de Querétaro, Querétaro de Arteaga, Mexico.
5. Hospital Médica Sur, CDMX, México.
6. The American-British Cowdray Medical Center I.A.P. Santa Fe Campus, Spine Clinic, CDMX, Mexico.
7. Arabella Klinik, München, Bayern, Germany.
8. Boston University School of Medicine, Cape Cod Healthcare, Hyannis, MA, USA.
9. Vanderbilt University Medical Center, Nashville, TN, USA.
10. CEMA, Pachuca, Hidalgo, México.
11. Center for Advanced Spine Care of Southern Arizona, Tucson, AZ, USA.,
12. Fundación Universitaria Sanitas Bogotá, Department of Orthopaedics, Bogotá, Colombia.
13. Colombian Academy of Medicine, Colombia.
14. Hospital Universitário Gaffree Guinle Department of Orthopedics, Rio de Janeiro, Brazil,
15. Universidade Federal do Estado do Rio de Janeiro, Rio de Janeiro, Brazil,
16. Brazilian Military Medical Academy, Rio de Janeiro, Brazil.

ABSTRACT

Introduction: The interest in spinal endoscopy is rising, particularly among younger spine surgeons. Formalized postgraduate training programs for endoscopic spinal surgery techniques are lacking behind. Methods: The authors performed a retrospective survey study amongst participants of the 2022 AMCICO endoscopic surgery symposium. Descriptive and correlative statistics were done on the surgeon's responses recorded in multiple-choice questions. In addition, surgeons were asked about their clinical experience and preferences with spinal endoscopy, training background, the types of lumbar endoscopic decompression they perform by approach, and future training requirements. SPSS (version 27) statistical software package was used for data analysis. Descriptive statistic measures were used to count responses and calculate the mean, range, standard deviation, and percentages. In addition, chi-square statistics were used to determine the strength of the association between factors. Results: The online survey was accessed by 321 surgeons, of which 92 completed it (53.4%). Demographic data showed the majority of responding surgeons being orthopedic surgeons (73.6%) and under the age of 50 (69.2%), with over half (51.1%) having less than three months of formalized training in endoscopic spinal surgery techniques. Most surgeons practiced uni-portal (58.9%) versus bi-portal (3.4%) spinal endoscopy. The transforaminal approach (65.5%) was preferred over the interlaminar method (34.4%). The bi-portal technique was indicated almost exclusively for the lumbar spine (94.8%). For endoscopically assisted spinal fusions, a uni-portal approach was preferred by 72% of surgeons over a bi-portal procedure (24.5%). 84.1% of respondents were interested in navigation, of which 30.7% preferred optical over electromagnetic technology (18.2%). Robotics was of interest to 51.1% of survey participants. Respondents' bias was estimated with course attendance assessments, with 37% of surgeons having attended all three days, 27.2% two days, and 16.3% one day. One-fifth of responding spine surgeons did not participate in any curriculum activities but completed the survey. The academic impact of the AMCICO endoscopy symposium was high, with 68.1% of respondents indicating interest in continued training and 61.1% of trainees ready to apply their newly acquired knowledge base to clinical practice. Conclusion: The interest in spinal endoscopy surgery techniques and protocols is high among AMCICO members. Many surgeons are interested in learning advanced endoscopic surgical techniques to integrate the technology into their surgical procedure portfolio to address common painful conditions of the degenerative spine beyond herniated discs and foraminal stenosis. The authors concluded that its academic impact was high based on the responses given by the participating surgeons. ***Level of evidence III; Retrospective study.***

Keywords: Surgeons; Surveys and Questionnaires; Surgical Procedures, Operative; Technology; Health Services Needs and Demand.

Study conducted by Center For Advanced Spinal Surgery in Tucson Arizona, USA.
Correspondence: Kai-Uwe Lewandrowski. 4787, E Camp Lowell Dr, Tucson, AZ, USA. 85712. business@tucsonspine.com

Received on 11/01/2022 accepted on 02/22/2023
Reviewed by: Rodrigo Amaral

RESUMO

Introdução: O interesse em cirurgia endoscópica da coluna tem aumentado especialmente entre os jovens cirurgiões, contudo, são poucos os centros que atualmente oferecem programas de treinamento nesta disciplina. Métodos: Foi realizada uma pesquisa retrospectiva entre os participantes do simpósio de "Cirurgia Minimamente Invasiva e Endoscópica da Coluna Vertebral" realizado durante o Congresso AMCICO 2022. Estatísticas descritivas e testes de correlação foram aplicados às respostas das perguntas de múltipla escolha. Os cirurgiões foram questionados sobre experiência clínica e preferências pela endoscopia espinhal, histórico de treinamento, tipos de descompressão lombar endoscópica que realizaram e requisitos futuros para um treinamento adicional. O software estatístico SPSS (versão 27) foi utilizado para a análise de dados. As medidas estatísticas descritivas foram utilizadas para quantificar as respostas e calcular a mediana, a média, o desvio padrão e as porcentagens. O qui-quadrado foi empregado para determinar a associação entre os fatores estudados. Resultados: A pesquisa on-line foi visualizada por 321 cirurgiões, dos quais 92 a completaram (53,4%). As informações demográficas mostraram que a maioria dos participantes são cirurgiões ortopédicos (73,6%) e menores de 50 anos (69,2%), com mais da metade deles (51,1%) possuindo menos de 3 meses de treinamento formal em técnicas endoscópicas. A maioria dos cirurgiões pratica abordagens uniportais (58,9%, contra 3,4% bi-portais). A abordagem transforaminal (65,5%) foi preferida em relação à abordagem interlaminar (34,4%). A abordagem biportal foi selecionada como a abordagem indicada para a região lombar (94,8%). Para a fusão endoscopia-assistida, a abordagem unilateral foi preferida por 72% dos participantes contra a abordagem biportal (24,5%). Os sistemas de navegação foram de interesse para 84,1% dos participantes, dos quais 30,7% responderam que preferiam a óptica em vez da eletromagnética (18,2%). O uso da robótica foi de interesse para 51,1% dos participantes. O viés dos participantes foi calculado com base no percentual de participação, onde 37% participaram de todos os 3 dias de conferências, 27,2% participaram de 2 dias e 16,3% participaram de apenas um dia. Um quinto dos cirurgiões não participaram das atividades do simpósio e ainda assim responderam à pesquisa. O impacto acadêmico do simpósio de "Cirurgia Minimamente Invasiva e Endoscópica da Coluna Vertebral" foi alto, com 68,1% dos participantes respondendo que têm interesse em treinamento adicional nestas técnicas e 61,1% respondendo que estão prontos para aplicar novos conhecimentos em sua prática médica. Conclusão: O interesse em técnicas cirúrgicas endoscópicas da coluna vertebral é alto entre os membros da AMCICO. Um grande número de cirurgiões está interessado em aprender técnicas cirúrgicas endoscópicas avançadas da coluna vertebral e integrar esta tecnologia como parte de suas ferramentas cirúrgicas para resolver problemas comuns que afetam a coluna com doença degenerativa, além de hérnias de disco e estenoses foraminais. Baseados nas respostas fornecidas pelos cirurgiões participantes, os autores concluem que o impacto acadêmico foi elevado. ***Nível de evidência III; Estudo retrospectivo.***

Descritores**:** *Cirurgiões; Inquéritos e Questionários; Procedimentos Cirúrgicos Operatórios; Tecnologia; Necessidades e Demandas de Serviços de Saúde.*

RESUMEN

Introducción: El interés por la cirugía endoscópica de columna ha aumentado especialmente entre los cirujanos jóvenes, sin embargo, pocos centros ofrecen actualmente programas de formación en esta disciplina. Métodos: Se realizó una encuesta retrospectiva entre los participantes en el simposio de "Cirugía Mínimamente Invasiva y Endoscópica de la Columna Vertebral" celebrado durante el Congreso AMCICO 2022. Se aplicaron estadísticas descriptivas y pruebas de correlación a las respuestas de las preguntas de opción múltiple. Se preguntó a los cirujanos acerca de la experiencia clínica y las preferencias para la endoscopia espinal, el historial de formación, los tipos de descompresión lumbar endoscópica que han realizado y los requisitos futuros para la formación continua. Para el análisis de los datos se utilizó el software estadístico SPSS (versión 27). Se utilizaron medidas estadísticas descriptivas para cuantificar las respuestas y calcular la mediana, la media, la desviación estándar y los porcentajes. Se empleó chi-cuadrado para determinar la asociación entre los factores estudiados. Resultados: La encuesta en línea fue vista por 321 cirujanos, de los cuales 92 la completaron (53,4%). Las informaciones demográficas demostraron que la mayoría de los participantes eran cirujanos ortopédicos (73,6%) y menores de 50 años (69,2%), y que más de la mitad de ellos (51,1%) tenían menos de 3 meses de formación formal en técnicas endoscópicas. La mayoría de los cirujanos practican abordajes uniportales (58,9%, frente a 3,4% biportales). Se prefirió el abordaje transforaminal (65,5%) al interlaminar (34,4%). El abordaje biportal se seleccionó como el indicado para la región lumbar (94,8%). Para la fusión asistida por endoscopia, el 72% de los participantes prefirieron el abordaje unilateral frente al abordaje biportal (24,5%). Los sistemas de navegación interesaron al 84,1% de los participantes, de los cuales el 30,7% respondió que prefería los ópticos a los electromagnéticos (18,2%). El uso de la robótica interesó al 51,1% de los participantes. El sesgo de los participantes se calculó en función del porcentaje de asistencia, donde el 37% asistió a los 3 días de conferencias, el 27,2% asistió 2 días y el 16,3% asistió sólo un día. Una quinta parte de los cirujanos no participó en las actividades del simposio y aun así respondió a la encuesta. El impacto académico del simposio de "Cirugía Mínimamente Invasiva y Endoscópica De La Columna Vertebral" fue elevado, ya que el 68,1% de los participantes respondieron que están interesados en seguir formándose en estas técnicas y el 61,1% respondieron que están preparados para aplicar los nuevos conocimientos en su práctica médica. Conclusión: El interés por las técnicas de cirugía endoscópica de la columna vertebral es elevado entre los miembros de AMCICO. Un gran número de cirujanos está interesado en aprender técnicas quirúrgicas endoscópicas avanzadas de la columna y en integrar esta tecnología como parte de sus herramientas quirúrgicas para abordar problemas comunes que afectan a la columna vertebral con enfermedad degenerativa, así como hernia discal y estenosis foraminal. Basándose en las respuestas proporcionadas por los cirujanos participantes, los autores concluyen que el impacto académico fue alto. ***Nivel de evidencia III; Estudio retrospectivo.***

Descriptores**:** *Cirujanos; Encuestas y Cuestionarios; Procedimientos Quirúrgicos Operativos; Tecnología; Necesidades y Demandas de Servicios de Salud.*

INTRODUCTION

For the first time, the Annual Congress of the Mexican Association of Spine Surgeons (AMCICO) included a three-day chapter dedicated to endoscopic spinal surgery with all its high-tech offerings available in Mexico. The AMCICO's leadership recognizes the growing interest of Mexican spine surgeons in this ultra-minimally invasive platform. A new generation of spinal surgeons is learning endoscopic procedures as part of their postgraduate program.[1-4] The increasing endoscopic procedures have generated the necessity to instruct the AMCICO membership on specific points, challenges, and these approaches complications[1-7] as good clinical outcomes ultimately depend on mastery of the learning curve.[8-12] Training programs and credentialing standards have yet to be defined by various organizations that group spine surgeons.[13,14]

The spinal endoscopy talks were presented scattered throughout the program compared to previous years; this time, national and

international leaders were invited to be part of the recent spinal endoscopy chapter for AMCICO. Topics ranged from decompression techniques to endoscopic-assisted fusion for degenerative pathology of the cervical to lumbar segments. Technological advances in navigation and robotics were also presented, and topics were discussed in which endoscopic techniques were compared with more traditional minimally invasive approaches. What was very clear in this three-day event is that many surgeons already use current endoscopic surgical techniques with a high level of skill with very similar results compared to recent international publications, which the invited professors presented.

The organizers of this event were interested in measuring the academic impact of the lectures and topics given during the event, requesting feedback from the attendees regarding their increased knowledge gained in understanding the scope of modern protocols used for the selection of patients who are candidates for endoscopic techniques, as well as their ability to implement useful tools that could increase the quality of care and outcomes of their patients. Likewise, those in charge showed special interest in knowing the preferences of their attendees regarding the use of technology and boarding. It is also of particular interest to understand in which direction efforts should be focused for developing the next program to be highly relevant to its participants. Finally, AMCICO needs to generate clinical practice guidelines to assist its members during the transition from image-based decision-making protocols to those based on the search for the pain generator for the treatment of degenerative conditions affecting the spine, which are precisely the starting point required for the use of endoscopic techniques and approaches. In this study, the authors summarize the findings from the responses to the survey conducted after the annual Congress.

MATERIAL AND METHODS

The authors sent an online survey (www.typeform.com) to 321 participants via email and social media chat groups, including messenger and WhatsApp. Surgeons were asked to answer several multiple-choice clinical questions related to the use of Endoscopy for the lumbar segment. Similarly, those surgeons who responded were asked about their type of professional practice, postgraduate residency, and training in spinal endoscopy. The author team wrote the questions to increase participation and minimize selection bias. The survey was conducted from September 18 to October 02, 2022. The authors were blinded as to the identity of the responding surgeons. After completing the survey responses, these were downloaded in Excel-compatible format and subsequently imported into IBM SPSS (version 27) statistical software for analysis. Descriptive statistical measures were used, calculating mean, average, standard deviation, and percentages. Chi-square was used to determine the strength of association between the factors studied. Missing questions were also included in calculating better percentages, indicated at each table's beginning. When possible, a p-value of 0.05 or less was considered statistically significant, and the 95% confidence interval was used for all tests.

The authors' study did not involve experimental works involving human beings. It was a survey study among spine surgeons. Therefore, the procedures involved in adhering to the ethical standards of the committee responsible for human experimentation (institutional and national) and the Declaration of Helsinki of 1975, revised in 2008, do not apply to this study. Therefore, approval by the local ethics committee was not necessary. Further, the authors' analysis did not require informed consent according to Resolution 466/2012 of the National Health Council of the Ministry of Health (Brazil), which addresses the Code of Ethics for Research in Human Beings or the Committee on Publication Ethics (COPE). The work described in the article does not involve animal experimentation. Therefore, permits and disclosures articulated by Law 11,794/08, which establishes procedures for the scientific use of animals and addresses the mandatory submission of research projects to the research ethics committees of the institutions, were not necessary.

RESULTS

Three hundred twenty-one surgeons had access to the online survey on the typeform.com site. 53.4% completed it. Ninety-two submitted their answers correctly. Demographic details of the responding surgeons are shown in Table 1. The majority of participating surgeons are under 50 years of age (69.2%). More than half (51.1%) reported having had less than three months of formal training in endoscopic spine surgery techniques. Only 35% had more than six months of training. Most of the spine surgeons turned out to be Orthopedists. (Figure 1)

The uniportal approach was the choice for 72% of the surgeons, in contrast to the biportal approach (24.5%) in cases where endoscopically assisted fusion was required. Most of the participating surgeons (84.1%) considered the navigation techniques useful, of which optical (30.7%) was preferred over electromagnetic (18.2%), and the rest (35.2%) had no preference and answered that they could use both. Regarding the use of robotics, opinions were very similar, with 51.1% in favor and 48.9% against. Uniportal endoscopy was performed by 58.9% of the participants, and biportal techniques by only 3.4%. Thirty-seven percent of the respondents confirmed that they had no particular interest in endoscopic spine surgery but still decided to participate by attending the sessions. The transforaminal approach was chosen by 65.5% over the interlaminar approach (34.4%). Biportal endoscopy was considered an exclusive technique for the lumbar spine (94.8%). (Figure 2)

Attendance at this chapter was mixed, with 37% of the surgeons participating on all three days, 27.2% on two days, and 16.3% on one day. One-fifth of the surgeons who responded to the survey did not participate in the academic activities of this symposium. Two-thirds of the participants agreed that the modules demonstrating these techniques were very interesting (68.1%). They commented that they would be willing to continue their training to master the learning curve. Some 20.2% responded that they had some interest in continuing with training. When we measured the academic impact of the AMCICO spinal endoscopy course, 61.1% of the attendees responded that they could apply new knowledge acquired in their daily medical practice. 23.2% said they would apply some of the material learned in their clinical practice. (Figure 2)

To measure the academic impact of this three-day AMCICO symposium on spinal endoscopy, participating surgeons were asked which technique they felt they could learn and use after 6 to 12 months. 58.2% of respondents indicated that uniportal techniques were more understandable to learn and apply than biportal. However,

Table 1. Demographic data of the surgeons surveyed.

		Frequency	Percentage	Valid percentage	Cumulative percentage
What is your medical specialty?					
	Neurosurgery	22	23.4	23.4	23.4
	Orthopedic Surgery	72	76.6	76.6	100
Valid	Total	100	100	100	
What kind of training do you have in spinal endoscopy?					
	Formal training (<3 months)	48	51.1	51.1	51.1
	Formal training (3 - 6 months)	13	13.8	13.8	64.9
	Formal training (> 6 months)	33	35.1	35.1	100
	Total	93	100.0	100.0	
How old were you during your training?					
	< 30	0	0	0	0
	31 - 40	37	39.4	39.4	39.4
	41-50	28	29.8	29.8	69.2
	51-60	19	20.2	20.2	89.4
	> 61	10	10.6	10.6	100
	Total	93	100.0	100.0	

Figure 1. Responses to questions regarding respondent demographics, navigation, robotics, endoscopic surgery preferences, and training are shown.

there was no significant difference in surgeons' preference, and the vast majority (91.5%) consider incorporating endoscopy as another tool in their portfolio of surgical options. Three-quarters of surgeons envisioned incorporating advanced techniques for cervical (75.5%), thoracic (75.6%), complex bilateral decompressions (88%), and endoscopic-assisted fusions (75.5%) as future practices integrated into their daily routine (Figure 3). Topics requested by participants for future Endoscopy chapters at AMCICO events are listed in Table 2.

DISCUSSION

The authors present a retrospective study regarding the academic impact of the symposium on Spine Endoscopy during the AMCICO 2022 Congress. Ninety-two surgeons completed the survey; most indicated they attended all three Chapter days. Demographic data show that most participants were orthopedic surgeons; neurosurgeons accounted for approximately one-fourth of the respondents. The highest average of respondents was under 50, suggesting that a generational transition from traditional open and minimally invasive to endoscopic surgery protocols is occurring within the AMCICO membership. In general, the participant's perception of the symposium was positive, qualified by the majority as very interesting and relevant to their professional practice. A small segment anticipated being able to implement the newly acquired knowledge into their clinical care processes. The authors in charge of this survey agreed that the academic impact of the Endoscopy Chapter was high.

Controversies were discussed on issues related to boarding and technical details. Respondents preferred uniportal surgery over biportal surgery and the transforaminal approach over the interlaminar approach. However, these differences were marginal and not statistically significant. There was also great interest in navigation and robotics technologies. Many surgeons showed interest in incorporating these technologies into their endoscopic platform, especially for endoscopy-assisted fusion procedures. The latter is the main topic requested by surgeons to be taken into account in future AMCICO academic activities. Respondents were also highly interested in endoscopic solutions for managing complex cervical and thoracic segment cases and requested more opportunities to participate in workshops at future congresses. As with any new technology, postgraduate training programs are scarce. This fact was also reflected in the participants' responses regarding specialized training in endoscopy. The need for training was high, as 51.1% of the surgeons indicated having had less than three months of exposure to the subject. Others reported between 3 and 6 months of postgraduate training, and only one-third reported having more than six months of training in endoscopic surgical techniques.

Some surgeons requested more time to discuss insurance coverage issues for these procedures, and one requested clarification on whether there was a conflict of interest among participants to eliminate bias. In the authors' opinion, the affiliation between speakers and providers was not a source of bias. The survey questions were directed toward a preference for some surgical technique and clinical decision-making instead of comparing the advantages/disadvantages of endoscopic equipment or brands. However, it is possible to state that there is a certain bias due to variations in attendance during the symposium. Only 37% of the participants

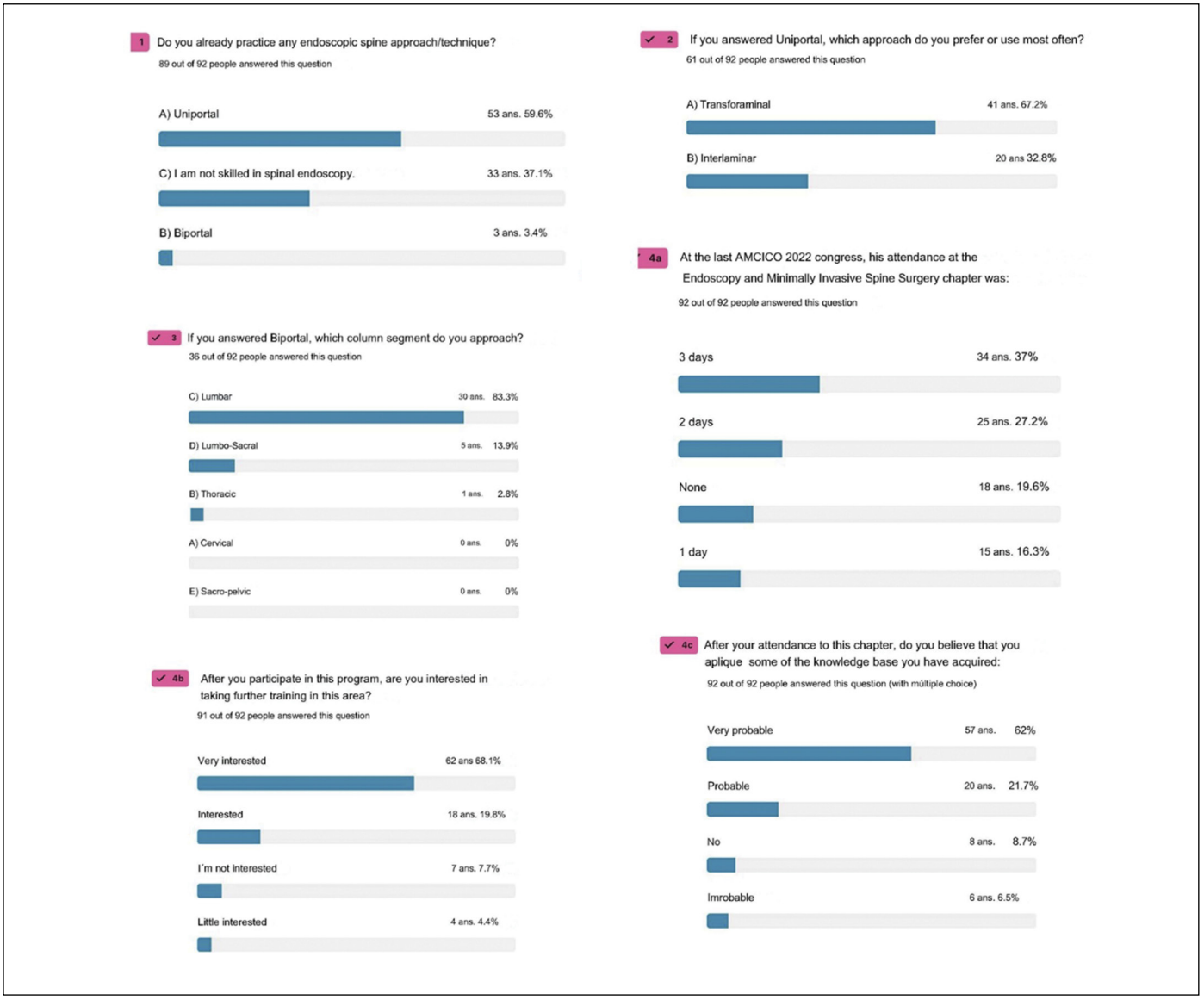

Figure 2. Surgeons' preferences regarding transforaminal vs. interlaminar and uniportal vs. biportal approaches for different spinal segments are shown. Ho-wever, 37% of the respondents may have introduced bias by answering that they had no interest in endoscopic surgery and did not attend the sessions offered during the three-day course. Additional confirmation and anchoring bias may have occurred because 19.6% of surgeons responded to the survey and did not participate in the symposium but still answered based on preconceived ideas about spinal endoscopy. The academic impact of the course on spinal endoscopy during the AMCICO congress, when analyzing the percentage (61.1%) of surgeons who answered that they could immediately apply some of the knowledge acquired during the course, could have been greater due to this negative bias.

were present during the three days, and 19.8% did not attend. Preconceived ideas about spinal endoscopy rather than the material presented during the course may have been a way of introducing cognitive bias.[15] Other limitations due to bias are likely to be present due to the retrospective nature of the survey.[16] Our response rate (53.4%) is higher than others previously reported for an online survey. This reflects the high interest and motivation of surgeons attending the Spine Endoscopy symposium during the AMCICO 2022 congress. The bias introduced by non-response due to low participation may have increased the accuracy of the survey and therefore does not represent a concern to the author team.[17,18] The average response rate for an in-person survey has been reported to be 57%, a mail survey 50%, an e-mail survey 30%, an online survey 29%, a telephone survey 18%, and those answered on apps 13%, bringing the overall average survey response rate to 33%.[19-26] The responses were blinded, and the authors had no information about the identity of the spine surgeons who responded to the survey, thus eliminating bias by intuition within the group of investigators.

CONCLUSIONS

Interest in endoscopic surgical techniques and protocols is high within the AMCICO membership. Two weeks later, responses to our post-congress survey indicate that some young surgeons already incorporate these techniques into their medical practice. In addition, many are interested in learning advanced endoscopic spine surgery techniques to address degenerative problems that commonly affect the spine beyond herniated discs and foraminal stenosis. More cadaver workshops and live surgeries were requested for future events. The authors concluded that the academic impact was high, based on the responses from surgeons who participated in the Endoscopic Spine Surgery chapter during the AMCICO 2022 congress.

All authors declare no potential conflict of interest related to this article.

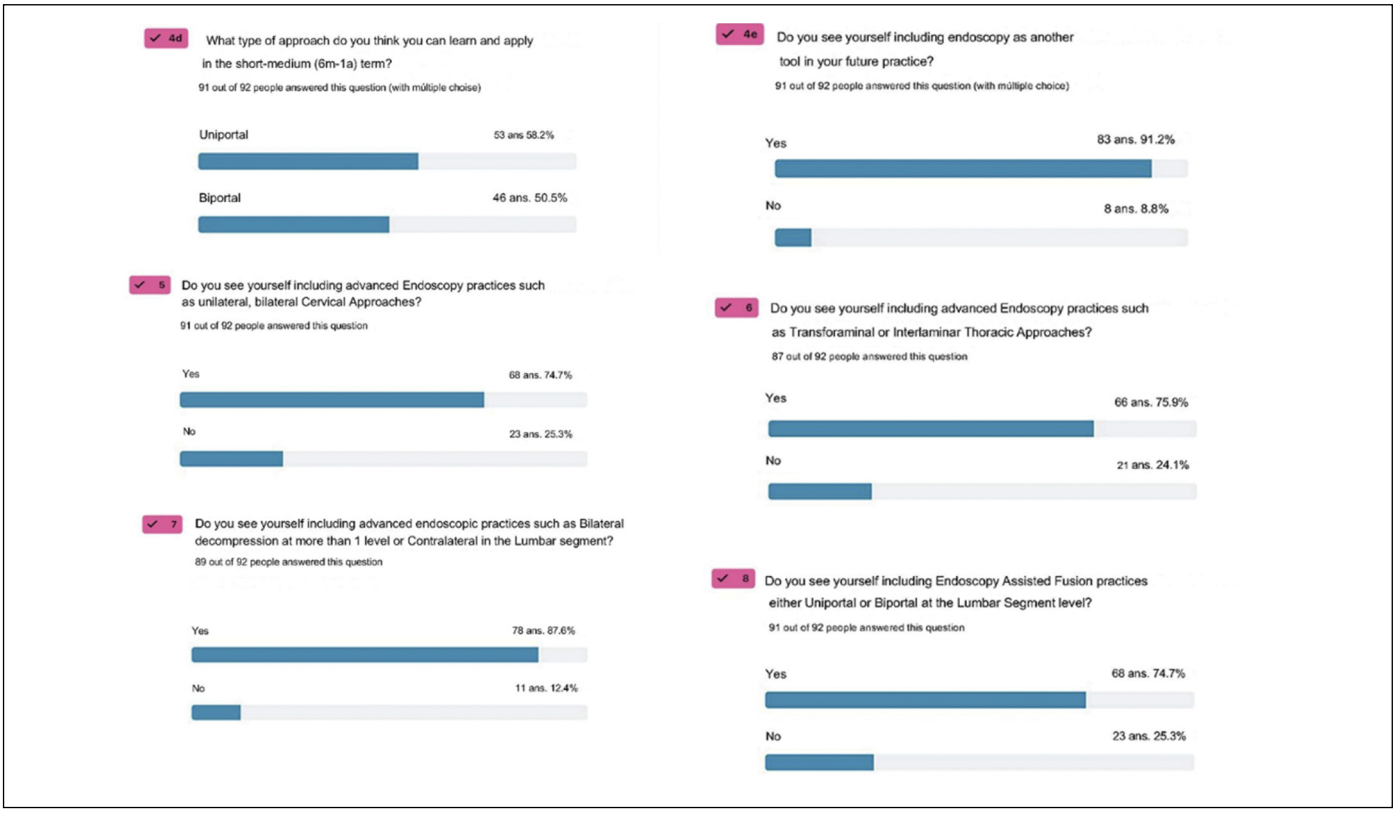

Figure 3. The academic impact of the AMCICO 2022 Spinal Endoscopy chapter was measured by analyzing the participants' answers concerning which technique they considered they could apply between 6 and 12 months after attending this course. They considered the uniportal techniques easier to learn than the biportal ones. Therefore, the acceptance of endoscopic spine surgery techniques was high among the surgeons who participated in the corresponding chapter during the AMCICO 2022 congress.

Table 2. Future topics requested by spine endoscopy symposium attendees at the AMCICO 2022 Congress.

1	Cervical & Thoracic Endoscopy
2	Endoscopic anatomy and complications
3	Multilevel narrow lumbar canal endoscopy
4	Radiculopathy secondary to radiofrequency in endoscopic surgery
5	Navigated and robotic surgery
6	Cervical degenerative surgery
7	Outcomes and management options for pathologies other than herniated discs
8	Anatomical models for practice
9	Tubular vs. Endoscopy
10	Listesis instabilities, treated with an endoscopic-assisted fusion
11	Bi-portal approaches and posterior and anterior cervical approaches.
12	Surgery with anterior and lateral approaches
13	Bi-portal inter-somatic fusion
14	Learning curves for the different endoscopic procedures
15	Insurance companies and spine surgery
16	Actual profit
17	Tips and tricks
18	Endoscopy vs. minimally invasive vs. open surgery
20	Interlaminar portals, their application, and reliability
21	Endoscopic XLIF
22	Fracture management
23	Long-term functional outcome of endoscopic surgery
24	Workshops on endoscopy, practical
25	It would be interesting to organize endoscopy courses in hospital institutions.
26	Selective endoscopic decompression in the senile patient
27	Multilevel lumbar decompression
28	Endoscopy in synovial cysts
29	Advanced program

CONTRIBUTIONS OF THE AUTHORS: Each author made significant individual contributions to this manuscript. Garcia A, Martinez EE, Margarita GS, Qillo-Olvera J, Canseco CAA, Garcia R, Solis SS, Hellinger S, Houle P, Gardocki R, and Lewandrowski KU: Conceptualization; Garcia A and Lewandrowski KU: Methodology; Lewandrowski KU: Software; Garcia A and Lewandrowski KU: Validation; Lewandrowski KU: Formal Analysis; Garcia A and Lewandrowski KU: Investigation; Garcia A and Lewandrowski KU: Resources; Lewandrowski KU: Data Curation; Garcia A and Lewandrowski KU: Writing-Original Draft Preparation; Garcia A: Writing-Review And Editing; Garcia A, Martinez EE, Margarita GS, Qillo-Olvera J, Canseco CAA, Garcia R, Solis SS, Hellinger S, Houle P, Gardocki R, and Lewandrowski KU; Supervision: Garcia A and Lewandrowski KU; Project Administration: Garcia A and Lewandrowski KU.

REFERENCES

1. Lewandrowski KU, Soriano-Sanchez JA, Zhang X, León JFR, Solis SS, Ortíz JGR, et al. Regional variations in acceptance, and utilization of minimally invasive spinal surgery techniques among spine surgeons: results of a global survey. J Spine Surg. 2020;6(Suppl 1):S260-74.
2. Hofstetter CP, Ahn Y, Choi G, Gibson JNA, Ruetten S, Zhou Y, et al. AOSpine Consensus Paper on Nomenclature for Working-Channel Endoscopic Spinal Procedures. Global Spine J. 2020;10(Suppl 2):111s-21s.
3. McGrath LB, White-Dzuro GA, Hofstetter CP. Comparison of clinical outcomes following minimally invasive or lumbar endoscopic unilateral laminotomy for bilateral decompression. J Neurosurg Spine. 2019:1-9.
4. Mayer HM. A History of Endoscopic Lumbar Spine Surgery: What Have We Learnt?. Biomed Res Int. 2019;2019:4583943.
5. Lewandrowski K, Hellinger S, Freitas Ramos MR, Soriano-Sánchez JA, Xifeng Z, Calderaro AL, et al. Dural tears during lumbar spinal endoscopy: surgeon skill, training, incidence, risk factors, and management. Int J Spine Surg. 2021;15(2):280-94.
6. Lewandrowski KU, Dowling A, Calderaro AL, Dos Santos TS, Bergamaschi JPM, León JFR, et al. Dysethesia due to irritation of the dorsal root ganglion following lumbar transforaminal endoscopy: Analysis of frequency and contributing factors. Clin Neurol Neurosurg. 2020;197:106073.
7. Lewandrowski KU. Incidence, Management, and Cost of Complications After Transforaminal Endoscopic Decompression Surgery for Lumbar Foraminal and Lateral Recess Stenosis: A Value Proposition for Outpatient Ambulatory Surgery. Int J Spine Surg. 2019;13(1):53-67.
8. Lewandrowski KU, Telfeian AE, Hellinger S, León JFR, de Carvalho PST, Ramos MRF, et al. Difficulties, Challenges, and the Learning Curve of Avoiding Complications in Lumbar Endoscopic Spine Surgery. Int J Spine Surg. 2021;15(Suppl 3):S21-37.
9. Son S, Ahn Y, Lee SG, Kim WK. Learning curve of percutaneous endoscopic interlaminar lumbar discectomy versus open lumbar microdiscectomy at the L5-S1 level. PLoS One. 2020;15(7):e0236296.
10. Ransom NA, Gollogly S, Lewandrowski KU, Yeung A. Navigating the learning curve of spinal endoscopy as an established traditionally trained spine surgeon. J Spine Surg. 2020;6(Suppl 1):S197-207.
11. Park SM, Kim HJ, Kim GU, Choi MH, Chang BS, Lee CK, et al. Learning Curve for Lumbar Decompressive Laminectomy in Biportal Endoscopic Spinal Surgery Using the Cumulative Summation Test for Learning Curve. World Neurosurg. 2019;122:e1007-13.
12. Sharif S, Afsar A. Learning Curve and Minimally Invasive Spine Surgery. World Neurosurg. 2018;119:472-8.
13. Lewandrowski KU, Soriano-Sanchez JA, Zhang X, Ramírez León JF, Soriano Solis S, Rugeles Ortíz JG, et al. Surgeon training and clinical implementation of spinal endoscopy in routine practice: results of a global survey. J Spine Surg. 2020;6(Suppl 1):S237-48.
14. Yeung A, Roberts A, Shin P, Rivers E. Suggestions for a Practical and Progressive Approach to Endoscopic Spine Surgery Training and Privileges. Spine. 2018;7(2).
15. Barcot O, Boric M, Dosenovic S, Cavar M, Kadic AJ, Pericic TP, et al. Adequacy of risk of bias assessment in surgical vs non-surgical trials in Cochrane reviews: a methodological study. BMC Med Res Methodol. 2020;20(1):240.
16. Zwaan L, Monteiro S, Sherbino J, Ilgen J, Howey B, Norman G. Is bias in the eye of the beholder? A vignette study to assess recognition of cognitive biases in clinical case workups. BMJ Qual Saf. 2017;26:104-10.
17. Probst P, Grummich K, Harnoss JC, Hüttner FJ, Jensen K, Braun S, et al. Placebo-Controlled Trials in Surgery: A Systematic Review and Meta-Analysis. Medicine. 2016;95(17):e3516.
18. Hernan MA, Hernandez-Diaz S. Beyond the intention-to-treat in comparative effectiveness research. Clin Trials. 2012;9(1):48-55.
19. What Does It Really Take to Build A 7-Figure Business?. [Accessed in March 17 2023]. Available at: https://www.questionpro.com/blog/good-survey-response-rate/.
20. Ketter S, Hatley N, Kennedy C, Lau A [https://www.pewresearch.org/]. What Low Response Rates Mean for Telephone Surveys [Accessed Sept 22 2019]. Available at: http://www.pewresearch.org/2017/05/15/what-low-response-rates-mean-for-telephone-surveys/.
21. Ramshaw A [https://www.genroe.com]. The Complete Guide to Acceptable Survey Response Rates [Accessed Sept 22 2019]. Available at: https://www.genroe.com/blog/acceptable-survey-response-rate-2/11504.
22. NSNC [http://socialnorms.org/]. What is an acceptable survey response rate? [Accessed Sept 22 2019.]. Available at: http://socialnorms.org/what-is-an-acceptable-survey-response-rate/.
23. Sefferman A [https://www.apptentive.com/]. Mobile Survey Response Rates: Averages and Benchmarks by App Category [Accessed Sept 22 2019]. Available at: http://www.apptentive.com/blog/2016/10/04/mobile-survey-response-rates/.
24. Todd AL, Porter M, Williamson JL, Patterson JA, Roberts CL. Pre-notification letter type and response rate to a postal survey among women who have recently given birth. BMC Med Res Methodol. 2015;15:104.
25. Brandt NJ, Cooke CE, Sharma K, Chou J, Carden MJ, Kumbera P, et al. Findings from a National Survey of Medicare Beneficiary Perspectives on the Medicare Part D Medication Therapy Management Standardized Format. J Manag Care Spec Pharm. 2019;25(3):366-91.
26. Odgaard L, Kothari M. Survey of oral nursing care attitudes, knowledge and practices in a neurorehabilitation setting. J Oral Rehabil. 2019;46(8):730-7.