

Prevention, Management, and Monitoring of Vertebral Artery Injuries. Current State of Knowledge of Spine Surgeons in Argentina

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ABSTRACT

Introduction: Vertebral artery injury is a serious event. The objective of this work is to evaluate the degree of knowledge of spinal surgeons in Argentina regarding the diagnostic and therapeutic measures of vertebral artery injury. **Materials and Methods:** An observational descriptive study was carried out through a survey transmitted through AANC and SAPCV. **Results:** Of 157 responses, 47.4% consider it relevant to evaluate the anatomy of the vertebral artery in all types of pathology by angiographic methods. Half of those surveyed diagnosed an anatomical variant of the artery, 29.2% reported having encountered an artery injury during their practice and only 35% had an action protocol for the management of this adverse event. 77% adopted tamponade as their first measure. In the postoperative follow-up, the majority of surgeons studied the final state of the situation using angiographic methods. Around 10% would try to establish some measure of antithrombotic prophylaxis. 76.6% have an hemodynamics service with an endovascular surgeon. **Conclusion:** We found an underestimation of this complication. Less than half of surgeons routinely use diagnostic tools for possible anatomical changes. Management or monitoring protocols for these injuries have not been observed.

Key words: Vertebral artery; cervical spine; complications.

Level of Evidence: IV

Prevención, manejo y seguimiento de las lesiones de la arteria vertebral. Conocimiento actual de los cirujanos de columna de la Argentina

RESUMEN

Introducción: La lesión de la arteria vertebral es un evento grave. El objetivo del estudio fue evaluar el grado de conocimiento de los cirujanos de columna en la Argentina sobre las medidas diagnósticas y terapéuticas de la lesión de la arteria vertebral. **Materiales y Métodos:** Se realizó un estudio descriptivo observacional mediante una encuesta difundida a través de la AANC y la SAPCV. **Resultados:** Se recibieron 157 respuestas. El 47,4% considera relevante evaluar la anatomía de la arteria vertebral en todo tipo de patología mediante métodos angiográficos. La mitad de los encuestados diagnosticó una variante anatómica de la arteria. El 29,2% manifestó haber tenido en su práctica una lesión de la arteria. Solo el 35% tiene un protocolo de acción para el manejo de este evento adverso. El 77% adopta como primera medida el taponamiento. En el seguimiento posquirúrgico, la mayoría estudia el estado final mediante métodos angiográficos. Alrededor del 10% procuraría instaurar alguna medida de profilaxis antitrombótica. El 76,6% dispone de Servicio de Hemodinamia con cirujano endovascular. **Conclusión:** Esta complicación está subestimada. Menos de la mitad de los cirujanos utiliza, como rutina, herramientas de diagnóstico de posibles alteraciones anatómicas. No se han observado protocolos de manejo ni seguimiento de estas lesiones.

Palabras clave: Arteria vertebral; columna cervical; complicaciones.

Nivel de Evidencia: IV

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INTRODUCTION

Intraoperative vertebral artery injury is a relatively rare and potentially serious event that can lead to massive bleeding, permanent neurological damage, and even death.¹ The most vulnerable anatomical pathways that expose the surgeon to this type of complication are anterior to C7, laterally between C3 and C6, and posterior in C1 and C2.^{2,3}

In the event of a vertebral artery injury, management goals include local control of bleeding and prevention of vertebrobasilar insufficiency and cerebrovascular embolic complications.^{4,5} Due to the low published rate (0.07-1.4%),² we have observed that there are discrepancies in the protocols for the evaluation, treatment, and monitoring of these injuries.

The tools available to the surgeon for the prevention and management of intraoperative injury of the vertebral artery are presurgical planning with the availability of adequate anatomical studies of the pathway in question,⁶⁻⁹ early diagnosis and establishment of repair techniques (tamponade, microvascular repair, ligation, or endovascular procedures), and follow-up protocols to prevent distant complications (rebleeding, thrombosis, or pseudoaneurysm).⁴

The objective of this study was to determine the degree of current knowledge of spine surgeons in Argentina on diagnostic and therapeutic measures for vertebral artery injury, and to evaluate epidemiological data and correlate the findings with recently published management consensus.

MATERIALS AND METHODS

An observational descriptive study was conducted with the aim of capturing the state of knowledge of spine surgeons in Argentina on the prevention and management of vertebral artery injuries. A survey was designed on the *Google Forms* platform (<https://docs.google.com/forms/d/1IR2wMKIwXcMdLnoqsAKTp-OFuHGmNykU7CU-6jaMZGXo/edit?ts=6016b285&gxids=7628>). The survey was disseminated through the database of the two scientific societies of the country that bring together spine surgeons in Argentina: the *Asociación Argentina de Neurocirugía* (AANC) and the *Sociedad Argentina de Patología de la Columna Vertebral* (SAPCV).

In parallel, an exhaustive review of the articles published in Google Scholar, Lilacs, and PubMed was carried out. The articles were grouped according to the levels of scientific evidence and criteria for the prevention, identification, management, and monitoring of vertebral artery lesions were identified.

RESULTS

157 answers were obtained with a formula distributed between both specialties, 57.3% of the respondents were orthopedic spine surgeons and 42.7%, neurosurgeons. 77.09% of the specialists had more than 5 years of experience and only 6.36% were trainees. 26.6% of them performed, on average, more than 40 cervical spine surgeries per year.

47.4% considered it relevant to evaluate the anatomy of the vertebral artery in traumatic, degenerative and tumor pathologies as well as deformities. The rest of the respondents affirmed that they evaluated it only in certain cases, among which tumor pathology, posterior cervical instrumentation, C1-C2 pathology and general traumatic pathology stand out.

Angiographic methods prevailed as those indicated for the artery study. 44.2% preferred CT angiography and 30.5% preferred resonance angiography for routine evaluation. In conventional anatomical studies (magnetic resonance imaging, computed tomography), 70.1% studied the anatomy of the vertebral artery using all planes (axial, coronal, and sagittal). Also, 70.1% suggested that the most vulnerable sector of the vertebral artery is the upper cervical spine.

About half of the respondents have had the opportunity to diagnose an abnormal anatomical variant of the vertebral artery. 16.9% have detected a high-riding vertebral artery; 15.6%, an abnormal vertebral artery; and 8.4%, a ponticulus posticus, among other variants.

29.2% of the sample reported having encountered at least one vertebral artery injury in their practice and 23.4% had at least two of these adverse events. The majority (42%) reported that they were performing a high posterior cervical procedure whereas a smaller, but not at all negligible, number of respondents (38%) said they had used an anterior route of the subaxial cervical spine.

Surgeons who reported vertebral artery injuries indicated that 48.9% had occurred in the decompression phase, 27.7% during instrumentation, and 23.4% during approach and exposure. 20% of patients suffered major complications (temporary deficit, cerebellar infarction, and death).

Only 35% of respondents had a well-defined protocol of action for the management of this adverse event. 77% of surgeons adopted tamponade as a first measure.

At post-surgical follow-up, the majority (74.5%) agreed to evaluate with CT angiography or MR angiography. About 10% would try to apply some measure of antithrombotic prophylaxis. 76.6% had a Hemodynamics Service with an endovascular surgeon in their institution.

DISCUSSION

Firstly, we interpreted that a representative sample of spine surgeons with vast experience could be accessed, since more than half of the respondents had more than 10 years in the development of their specialty,¹⁰ and about a third of them performed an average of one cervical spine surgery per week.

In the literature, it is stated that evaluation with the corresponding imaging studies is essential as part of pre-surgical planning;^{2,6-9} its evaluation and consideration before all cervical procedures is encouraged.¹

Although we consider the selection criterion for the assessment is appropriate, given that, in conventional studies (computed tomography, magnetic resonance), the surgeons analyze all the planes and prefer angiographic studies for an objective assessment,⁵⁻⁷ it is striking that less than 50% of them consider the evaluation of the vertebral artery useful in all pathologies, and degenerative cervical pathology is the one in which the anatomical examination and variants of this vascular structure are least contemplated.

The most relevant piece of information in this study has been the prevalence of vertebral artery injuries in spine surgeons in Argentina. Approximately one in three respondents had encountered at least one injury of this structure as a complication. Although most had been the product of an approach in the upper cervical spine, in coincidence with the published cases,² we must point out that about 40% occurred during an anterior route of the subaxial cervical spine.

The most frequent surgical action at the time of injury was decompression for both anterior and posterior approaches. In the latter, a higher risk of injury during exposure has been published.⁴

The current approach to managing these injuries once they have already occurred attaches special importance to the preparation for a possible case^{1,2} and to the review of the steps to be followed in the event of this contingency. In our study, although most specialists agreed that the first action to be adopted was tamponade, most have stated that they did not take into account action protocols for the management and monitoring of these injuries in their Services.

CONCLUSIONS

Data from our survey of spine surgeons in Argentina indicate that this complication is underestimated, since one in three surgeons encountered this complication and about half of them occurred during the approach or decompression of the subaxial cervical spine.

While they know the tools they can use for the timely diagnosis of anatomical factors involving a risk of vertebral artery injury and use them appropriately, less than half of surgeons use these tools routinely.

Regarding therapeutic measures, no management protocols or follow-up of these lesions have been observed.

We highlight the importance of performing a prior recognition of the intrinsic risk factors of each approach and the particular anatomy of the vertebral artery in each patient. To obtain the best functional outcome in the patient, it is necessary to anticipate a possible injury.

Conflict of interests: The authors declare they do not have any conflict of interests.

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