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ADAMKIEWICZ'S ARTERY IN ENDOSCOPIC SURGERY: NARRATIVE REVIEW

ARTÉRIA DE ADAMKIEWICZ NA CIRURGIA ENDOSCÓPICA: REVISÃO NARRATIVA

ARTERIA DE ADAMKIEWICZ EN CIRUGÍA ENDOSCÓPICA: REVISIÓN NARRATIVA

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ABSTRACT

Endoscopic spine surgery has become increasingly popular among specialized surgeons, driven by its minimally invasive approach and increasing clinical versatility. Initially restricted to the lumbar spine, its indications have expanded to the cervical region and, to a lesser extent, the thoracic region, offering a less aggressive and more affordable alternative to traditional procedures such as laminectomy, costotransversectomy, and the anterior extracavitary approach to the thoracic spine. During interventions in this segment, it is common to identify segmental vessels, whose anatomical position may vary depending on the surgical level. In certain cases, the segmental artery and vein overlap or invade the disc space, becoming critical structures to consider during endoscopic decompression. This study's primary objective was to highlight the relevance of Adamkiewicz's artery in endoscopic spinal surgery. To this end, a narrative review was conducted according to the PRISMA method guidelines, structured according to the PICOS criteria: adults, as defined by the World Health Organization (Population); endoscopic procedures involving the artery of Adamkiewicz (Intervention); surgical techniques that do not consider this vascular structure (Comparison); and clinical trials and case studies (Outcome). The analysis culminated in the selection of 20 articles, which supported the discussion and the findings presented. It is concluded that accurate identification of the artery of Adamkiewicz is essential for preventing neurological complications, and its preservation is a determining factor in reducing the risk of spinal cord ischemia during spinal procedures. Advanced imaging techniques, such as magnetic resonance angiography, have demonstrated high efficacy in locating this vessel, allowing surgeons to plan minimally invasive approaches with greater precision and safety. ***Level of Evidence III; Review Article***.

Keywords: Spine; Arteries; Minimally Invasive Surgical Procedures.

RESUMO

A cirurgia endoscópica da coluna tem-se consolidado como uma técnica cada vez mais difundida entre cirurgiões especializados, impulsionada por sua abordagem minimamente invasiva e pela crescente versatilidade clínica. Inicialmente restrita à coluna lombar, suas indicações expandiram-se para a região cervical e, em menor escala, para a torácica, oferecendo uma alternativa menos agressiva e mais acessível em relação a procedimentos tradicionais, como a laminectomia, a costotransversectomia e a abordagem extracavitária anterior da coluna torácica. Durante intervenções nesse segmento, é comum a identificação de vasos segmentares, cuja posição anatômica pode variar conforme o nível cirúrgico. Em determinados casos, a artéria e a veia segmentares sobrepõem-se ou invadem o espaço discal, tornando-se estruturas críticas a serem consideradas durante a descompressão endoscópica. Este estudo teve como objetivo principal evidenciar a relevância da artéria de Adamkiewicz na cirurgia endoscópica da coluna vertebral. Para tanto, foi realizada uma revisão narrativa conforme as diretrizes do método PRISMA, estruturada segundo os critérios PICOS: adultos, conforme definição da Organização Mundial da Saúde (População); procedimentos endoscópicos que envolvem a artéria de Adamkiewicz (Intervenção); técnicas cirúrgicas que não consideram essa estrutura vascular (Comparação); e ensaios clínicos e estudos de caso (Desfecho). A análise culminou na seleção de 20 artigos, os quais embasaram a discussão e sustentaram os achados apresentados. Conclui-se que a identificação precisa da artéria de Adamkiewicz é essencial para a prevenção de complicações neurológicas, sendo sua preservação um fator determinante na redução do risco de isquemia medular durante procedimentos espinhais. Técnicas avançadas de imagem, como a angiografia por ressonância magnética, têm demonstrado elevada eficácia na localização desse vaso, permitindo aos cirurgiões planejar abordagens minimamente invasivas com maior precisão e segurança. ***Nível de Evidência III; Artigo de Revisão.***

Descritores: *Coluna Vertebral; Artérias; Procedimentos Cirúrgicos Minimamente Invasivos.*

RESUMEN

La cirugía endoscópica de columna se ha vuelto cada vez más popular entre los cirujanos especializados, gracias a su abordaje mínimamente invasivo y a su creciente versatilidad clínica. Inicialmente restringida a la columna lumbar, sus indicaciones se han expandido a la

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región cervical y, en menor medida, a la torácica, ofreciendo una alternativa menos agresiva y más asequible a procedimientos tradicionales como la laminectomía, la costotransversectomía y el abordaje extracavitario anterior a la columna torácica. Durante las intervenciones en este segmento, es frecuente identificar vasos segmentarios, cuya posición anatómica puede variar según el nivel quirúrgico. En ciertos casos, la arteria y la vena segmentarias se superponen o invaden el espacio discal, convirtiéndose en estructuras críticas a considerar durante la descompresión endoscópica. El objetivo principal de este estudio fue destacar la relevancia de la arteria de Adamkiewicz en la cirugía endoscópica de columna. Por lo tanto, se realizó una revisión narrativa según las directrices del método PRISMA, estructurada según los criterios PICOS: adultos, según la definición de la Organización Mundial de la Salud (Población); procedimientos endoscópicos que involucran la arteria de Adamkiewicz (Intervención); técnicas quirúrgicas que no consideran esta estructura vascular (Comparación); y ensayos clínicos y estudios de caso (Resultados). El análisis culminó con la selección de 20 artículos que respaldaron la discusión y los hallazgos presentados. Se concluye que la identificación precisa de la arteria de Adamkiewicz es esencial para prevenir complicaciones neurológicas, y su preservación es un factor determinante para reducir el riesgo de isquemia medular durante procedimientos de columna. Las técnicas de imagen avanzadas, como la angiografía por resonancia magnética, han demostrado una alta eficacia en la localización de este vaso, lo que permite a los cirujanos planificar abordajes mínimamente invasivos con mayor precisión y seguridad. ***Nivel de Evidencia III; Artículo de Revisión.***

Descriptores: *Columna Vertebral; Arterias; Procedimientos Quirúrgicos Mínimamente Invasivos.*

INTRODUCTION

Endoscopic spinal surgery has consolidated itself as one of the main developments in the minimally invasive treatment of spinal diseases. Initially restricted to the lumbar region, its application has expanded to the cervical and chest segments, driven by advances in optics, instrumentation and access techniques. In the thoracic segment, specifically, the endoscopic approach represents a less aggressive alternative compared to conventional techniques such as laminectomy, costotransversectomy and previous extracavitary approach, offering less morbidity and reduced recovery time. However, the anatomical challenge in this segment is significant, mainly due to the presence of critical vascular structures, such as the segmental thoracic vessels, which often overlap with the intervertebral disc and can become obstacles to surgical access. In certain situations, the bonding of these vessels may seem necessary to ensure proper decompression.[1]

In this context, Adamkiewicz's artery (AAK), or magna root artery, is highlighted as a central element of concern. This artery is responsible for supplying the lower portion of the spinal cord and exhibits great anatomical variability, usually emerging between levels T8 and L2, predominantly on the left. The inadvertent lesion of this structure, although rare, can result in catastrophic neurological consequences, such as spinal cord ischemia and paraplegia. Although this risk is well recognized in open surgeries, its relevance can be underestimated in the endoscopic context, given the false sense of safety associated with the less invasive technique.[2] This perception is aggravated by the increased performance of chest procedures in outpatient surgical centers, sometimes without adequate multidisciplinary support to handle severe vascular or neurological emergencies.[3]

This study aims to highlight the importance of the identification and preservation of AAK during thoracic endoscopic procedures. In addition, it proposes guidelines for risk stratification and careful selection of patients, aiming at minimizing the risk of vascular lesions in a scenario of increasing adoption of endoscopic surgery in the chest spine.

METHODOLOGY

A structured search of the literature was conducted in the databases PubMed, SciELO and LILACS, with the aim of identifying relevant studies related to AAK, its anatomical variations, methods of identification and surgical implications, especially in the context of endoscopic surgery of the chest spine. It also included articles cited as reference in the initially selected studies, as well as relevant books, with the aim of expanding thematic coverage. The search strategy involved crossing the descriptors "endoscopic surgery" and "Adamkiewicz artery", using the Boolean operator AND, with initial selection by title, followed by sorting by summaries and, subsequently, full reading of the texts considered eligible.

A narrative approach of literature review was chosen, due to the heterogeneity of the methodological drawings found, which included prospective clinical studies, cadaveric anatomical studies, technical reports, reviews and experimental models. This option allowed the critical and integrative synthesis of the available data, without the application of methodological quality assessment tools, such as those recommended in systematic reviews. The goal was to integrate and contextualize the existing knowledge in a didactic and applicable way to minimally invasive surgical practice, especially in the chest spine.

The eligibility criteria adopted included national and international articles, written in Portuguese, English or Spanish, with full text available. As exclusion criterion, the papers that did not meet the objectives proposed in this research were excluded.

RESULTS

Initially, 35 articles were identified in SciELO, 20 in LILACS and 105 in PubMed, totaling 160 studies. After the removal of duplicates (n = 20), 140 unique jobs remained. The preliminary analysis of the titles resulted in the exclusion of 105 articles because they did not directly relate to the research objectives. Thus, 35 studies were selected for reading the summaries, of which 30 presented relevance and were read in full. At the end of this process, 20 studies met the established eligibility criteria and were included in the qualitative analysis of this review (Table 1). The remaining 10 articles were excluded because they did not directly address the central topics of the research.

From the selected studies, the main aim was to conceive the Adamkiewicz artery (AAK), describe the contemporary techniques for its identification and discuss the main complications related to its manipulation in the surgical context.

Buffolo et al. (2002)[4] presented an innovative approach to the treatment of aneurysms and dissections type B of the descending aorta, using self-expanding stents coated with polyester in a prospective study with 91 patients. The success rate was 91.1% without records of paraplegia, demonstrating a promising alternative to conventional surgical treatment, with lower morbidity and possibility of early intervention.

Lewandrowski et al. (2019)[1] conducted a retroprospective study with 1,839 patients undergoing transforaminal endoscopic decompression for lumbar stenosis, with an average follow-up of 33 months. Excellent or good results were observed in 82.2% of cases with extruded disc fragment, and the postoperative complications, when present, were generally self-limited and successfully managed with supporting measures.

Nijenhuis et al. (2007)[5] conducted a prospective interventionist study with 60 patients, demonstrating that AAK and its associated segmental artery (AS-AAK) could be identified in 100% of cases, between vertebral levels T8 and L2, with predominance on the left side in 72% of patients. MRI angiography was effective in locating preoperative AAK in all cases with thoracic abdominal aneurysm.

Krings et al. (2005)[6], in a review of the literature on spinal

Table 1. Main findings of the 20 articles included in the review.

Author (Year)	Type of Study	Main focus	Principal Findings
Buffolo et al. (2002)[4]	Prospective study	Treatment of type B aneurysms with Stent.	High success rate, no cases of paraplegia.
Lewandrowski et al. (2019)[1]	Retrospective study	Endoscopic transforaminal lumbar decompression.	Clinical efficacy with low complications rate.
Nijenhuis et al. (2007)[5]	Prospective interventionist study	AAK identification by MR angiography.	AAK identified in 100% of cases, most to the left.
Krings et al. (2005)[6]	Literature review	Spinal vascular malformations.	Preferred endovascular treatment for MAVs.
Ruetten et al. (2018)[2]	Prospective study	Thoracic endoscopic decompression.	Effective and minimally invasive procedure.
N´da et al. (2016)[3]	Microsurgical dissection of corpses	Topography da AAK.	AAK to the left at 86%, while T8-T10 at 73%.
Li et al. (2020)[7]	Prospective interventionist study	PEPD for thoracic myelopathy	Minimal complications, good results with early treatment.
Piola et al. (2020)[8]	Observatory Study (ATCM)	Location of AAK.	Identification at 82.5%, left-wing predominance.
Kudo et al. (2003)[9]	Double-blind randomized study	AAK view by TCMD.	View at 68%, origin between T10-L2.
Boll et al. (2004)[10]	Double-blind randomized study	ATC with high resolution.	High quality, reproducible 3D images.
Zolot (2017)[11]	Literature review	Limitations on routine AAK identification.	Highlighting ethnic variations.
Kroszczynski et al. (2013)[12]	Interventionist study with corpses	Topography of the spinal arteries.	Increased probability with anterosuperior needles.
Rubino et al. (2000)[13]	Animal experimental study	cervical/thoracic endoscopy in pigs.	Good exposure and visibility.
Puertas et al. (1998)[14]	Interventionist study	Correction of scoliosis by posterior route.	Variable rates of neurological complications.
Telfeian et al. (2016)[15]	Observational study	Thoracolumbar T12-L1 discectomy	Safe and effective technique
Yeung et al. (2003)[16]	Literature review	Thoracic and lumbar foraminal access	Accessibility between T10-L4, continuous evolution
Yue et al. (2015)[17]	Literature review	Indications and complications of endoscopic surgery	Technical advances with good applicability
Melissano et al. (2009)[18]	Observational study	TC for identification of AAK	85% agreement, AAK in left intercostal artery
Utsunomiya et al. (2008)[19]	Interventionist study	Contrast protocols for TC	Improved visualization with quick injection
Kim et al. (2020)[20]	Literature review	Expansion of endoscopic surgery indications	Emphasis on prevention of complications

vascular malformations, highlighted that patients with spinal cord cavernomas and perimedullary fistulas type I are candidates for surgical treatment. Dural arteriovenous fistulas can be treated both surgically and endovascularly. Endovascular treatment is considered the first choice, although combined therapies may be considered in specific situations.

Ruetten et al. (2018)[2] Evaluated, in a prospective study with 55 patients, the efficacy of uniportal endoscopic decompression in the thoracic spine, using interlaminar, extraforaminal or retropleural accesses transthoracic. The authors demonstrated that the technique is minimally invasive and capable of providing adequate decompression safely.

N'da et al. (2016)[3] they realized microsurgical dissection of 15 spinal cords from fresh corpses, analyzing the junction between the AAK and the anterior spinal artery. AAK dural intersection was identified on the left side in 86% of cases, most frequently between T8–T10 (73.3%) and between L1–L2 (26.7%). These anatomical findings are essential for the planning of surgical procedures in the thoracic abdominal aorta and the thoracic column.

Li et al. (2020)[7] investigated 30 patients with yellow ligament ossification thoracic myelopathy treated with percutaneous posterior endoscopic decompression (PEPD). Complications occurred in two patients (6.7%), with dural ruptures. Patients without signs of T2 hyperintensity had good recovery when treated early.

Piola et al. (2020)[8] analyzed 86 multidetector computed angiotomography (ATCM) examinations, identifying AAK in 82.5% of cases. The origin of the artery was located between T9 and T11 in 79.2% of patients, predominantly on the left side (91,5%). The data confirm the effectiveness of ATCM in preoperative identification of AAK.

Kudo et al. (2003)[9], in a randomized double-blind study in Brazil, evaluated 19 patients with known or suspected liver disease. AAK was visualized in 68% of cases, originating between T10 and L2. Multi-detector and intravenous contrast tomography has been shown to be effective in the identification of AAK and anterior spinal artery (AEA).

Boll et al. (2004)[10] conducted a double-blind, randomized and placebo-controlled study with 18 men (average age of 67 years) with aneurysmatic or occlusive vascular diseases in the lower extremities. The increased temporal and spatial resolution allowed the obtaining of high-quality computerized angiotomography (ATC) images. Automated 3D visualization tools have generated reliable, reproducible and efficient central line extracts comparable to those manually defined.

Zolot (2017)[11], in a literature review, highlighted that the use of intravenous contrast, coupled with the demands of time and resources, limits the routine identification of AAK in most diagnostic centers. With the growth of procedures that affect spinal cord infusion, the author suggests that relevant anatomical differences between ethnic groups should be considered in clinical planning.

Kroszczynski et al. (2013)[12] conducted an experimental anatomical study involving the dissection of 24 embalmed cadavers, identifying 39 anterior radiculomedullary arteries within the thoracolumbar foramina (T4–L2), of which 23 were classified as large radiculomedullary arteries, including the artery of Adamkiewicz (AAK). The study demonstrated that the likelihood of locating these arteries increases significantly when needles are positioned in the anterosuperior region of the nerve, offering important guidelines for safer surgical approaches.

Rubino et al. (2000)[13] developed an experimental model in five pigs to evaluate the minimally invasive endoscopic approach of

the anterior cervical spine and upper chest. All animals tolerated the procedure well, which allowed excellent visibility and full exposure of vertebral levels from C1 to T3. The technique has demonstrated potential to reduce morbidity associated with the open cervical approach, offering a broader and safer exposure compared to conventional surgery.

Puertas et al. (1998)[14] conducted an experimental and interventionist study with 80 patients submitted to postoperative surgical correction of idiopathic scoliosis. Among patients treated with arthrodesis and instrumentation with Harrington's rod, 2.64% presented reversible neurological damage. In the group operated with Hartshill rectangle, 4% developed with permanent neurological lesions and 8% with reversible lesions. Among those treated with a combination of Harrington and Luque stems, 5.88% presented reversible neurological changes. The results obtained are compatible with the data reported in large series of scientific literature, reinforcing the importance of the appropriate choice of surgical technique to minimize neurological risks.

Telfeian et al. (2016)[15] evaluated medical records of three patients with T12-L1 disc hernia, all undergoing transforaminal endoscopic discectomy and foraminotomy. The preoperative average score on the analog visual scale was 8.3, and the results indicated that both techniques are safe and effective for the treatment of thoracolumbar radiculopathy.

Yeung et al. (2003)[16], in a review of literature on endoscopic surgery, emphasized that the foraminal approach is accessible from T10 and L4-5, and may include L5-S1 with specific techniques, such as lateral facet foraminoplasty. The technical refinement has broadened the indications and improved clinical results.

Yue et al. (2015)[17], in a review of literature on techniques of spinal endoscopic surgery, highlight that the main indications include disc hernias, canal stenosis, infections and interbody fusion. Advances such as modifications in the size of the endoscope and the angle of the field of vision enabled anterior and posterior cervical decompression. The use of endoscopic mills, electrocautery and focused laser has made these techniques less invasive and applicable to patients of all ages and biotypes. Related complications include dural ruptures, dysesthesia, nerve injury, and infection.

Melissano et al. (2009)[18] conducted an observational study with the analysis of 67 computed tomographs of patients undergoing thoracic or thoracic abdominal aortic procedures, demonstrating that the identification of AAK presented substantial agreement of 85.07% between the methods. In 83.3% of cases, the origin of AAK was a left intercostal artery. The study demonstrated that the non-invasive location of AAK using open source software OsiriX and low-cost hardware is viable and effective, allowing precise navigation of CT data for detailed vascular study.

Utsunomiya et al. (2008)[19] conducted an experimental and interventionist study with 80 patients with aneurysm of the descending aorta or thoracic abdominal, evaluating contrast protocols for angiography by computed tomography with 64 detectors. The rapid contrast injection (1.75 g of iodine/s) demonstrated significantly higher aortic attenuation (above 450 HU), providing better AAK visualization compared to slow injection, confirming the effectiveness of the optimized protocol for precise vascular identification.

Kim et al. (2020)[20], in a literature review, highlighted that, with the advancement of clinical experience, the indications for endoscopic surgery of the spine and percutaneous instrumentation have been expanded to include not only lumbar paramedian disc hernias, but also central hernias, high-grade migrations, seizures, thoracic and cervical, as well as lumbar canal stenosis. The study highlights the importance of surgeons being aware of the possible complications and limitations of these procedures in order to adopt preventive measures that minimize adverse events. This understanding is essential for patient safety and surgical success.

DISCUSSION

AAK, also known as magna root artery, is a crucial blood vessel in supplying blood to the spinal cord.[5,20] Scientific evidence indicates that the identification and preservation of this artery during interventions in the spine is crucial for preventing serious ischemic complications, such as paraplegia, as demonstrated by Li et al. (2020).[7] In this regard, Nijenhuis et al. (2004)[5] highlight the importance of performing preoperative angiography for accurate mapping of the location of the artery, allowing surgeons to avoid unexpected lesions during endoscopic approach. This practice has been shown to be effective in improving postoperative outcomes, contributing to greater safety and accuracy in minimally invasive procedures.[8,21]

Segundo Nijenhuis et al. (2004)[5], paraplegia and paraparesis secondary to spinal cord ischemia remain relevant complications in thoracic abdominal surgeries, with an incidence of between 5% and 11%. One of the main causes is the failure to restore spinal blood supply, and the reconnection of the intercostal or lumbar arteries associated with AAK is essential.[6] The preoperative identification of AAK, coupled with the visualization of these arteries, helps in delimiting the aortic areas that require graft replacement and vascular reconstruction. Piola et al. (2020)[8] highlight that advanced imaging techniques, such as angiography magnetic resonance imaging and computed tomography, are fundamental to accurately locate AAK, significantly reducing the risk of neurological complications.

The literature highlights the importance of contingency strategies during surgical procedures, especially in the face of anatomical variations or atypical location of AAK.[9] In these contexts, intraoperative neuromonitoring (NMIO) is fundamental. As discussed by Piola et al. (2020)[8], integrating advanced imaging techniques with NMIO is an indispensable resource to improve surgical outcomes and ensure greater patient safety.

Segundo Kim et al. (2020)[20], lesion of the lumbar radicular artery during endoscopic surgery of the spine can provoke retroperitoneal hematoma, sometimes requiring surgical drainage. There are reports of intraoperative angiography and iliac artery embolization as a therapeutic approach. It is also possible the bleeding of the epidural venous plexus, whose inadequate containment can evolve into epidural hematoma.

In endoscopic surgeries, imaging technology is essential for accurate identification of AAK.[10] Advanced techniques, such as computed tomography (TC) and magnetic resonance imaging (RM), provide detailed images that favor their exact location, increasing the safety of the procedure and reducing the risk of neurological complications.[11,12]

Segundo Nijenhuis et al. (2004)[5], the most reliable way to visualize AAK is through selective intercostal arterial angiography, with detection rates ranging from 43% to 86%. Although effective, this method is time-consuming and can lead to complications, including spinal cord injury. As a less invasive alternative, magnetic resonance imaging (MRI) and computed tomography (CT) angiography have been used, with reports of detection rates between 67%–93% and 68%–90%, respectively.

In general, the intercostal and lumbar arteries, together with their dorsal branches, travel trajectories close to bone structures. Originating from the aorta, these arteries divide into anterior and posterior branches. The previous branches follow the intercostal swamp, while the later branches are subdivided into muscular branch and radiculomedullary artery, the latter directing to the spine and penetrating the vertebral foramen. The AAK, the main anterior radiculomedullary artery, connects to the anterior spinal artery through a typical clamp-shaped curve (Figure 1).

Due to the anatomical particularities, the contrast-noise ratio (CNR) in the spinal canal is reduced, which can obscure the visualization of AAK and its continuity with the aorta. Although intensive aortic enhancement is essential for detecting small-caliber vessels, intravenous contrast ATC has limitations as the contrast medium is diluted in the circulation on the right side of the heart.[7] Nojiri et al. (2007)[21] demonstrated that ATC with intra-arterial contrast allows tracing AAK to the aorta, thanks to the high contrast obtained.

In addition to its anatomical relevance, recent studies show the variability in the origin and trajectory of AAK, reinforcing the need for precise definitions during preoperative planning. According Kroszczynski et al. (2013)[12], AAK usually emerges from the left side of the aorta between T8 and L2, with a higher incidence between T9 and T12, and may, in less common cases, emerge at lower levels

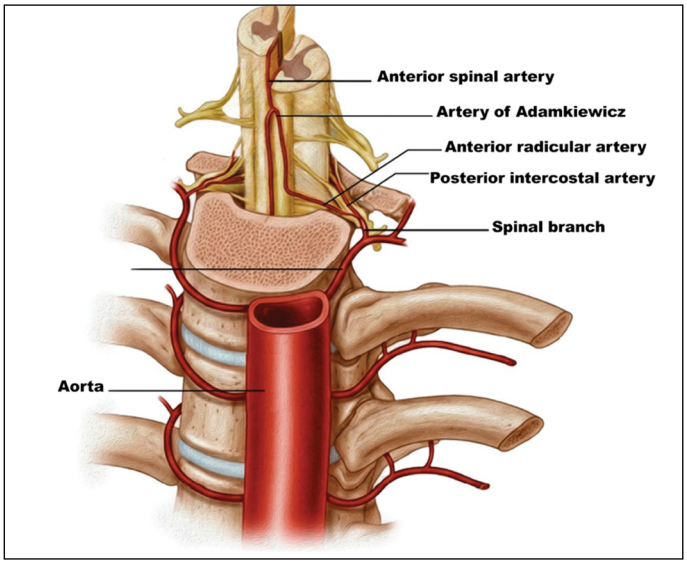

Figure 1. Branches from the thoracic aorta to the Adamkiewicz artery. From the aorta, the posterior intercostal artery is branched, which originates the vertebral, dorsal and spinal branches. The latter is subdivided into anterior and posterior root artery. Adamkiewicz's artery, known as the magna radicular artery and the largest and most important anterior radicular artery, follows towards the anterior spinal artery, being the main artery that supplies the lower two-thirds of the spinal cord, from the lower thoracic portion to the *conus medullaris*.

such as L2-L3. There are reports of its identification after spinal cord infarction due to epidural injection of steroid, recommending application at a low level, near the caudal pedicle. In about 15% of patients, it originates in T8, with a diameter between 0.6 and 1.8 mm.[12] When occluded, there may be collateral supply through muscular, intercostal or lumbar arteries. Lesions in the AAK can cause anterior spinal cord syndrome, with significant motor impairment, preservation of sensitivity and possible sphincter dysfunctions.[13]

A considerable variation in the origin of this artery among patients is observed, which highlights the importance of individualized evaluations before conducting endovascular procedures.[8] Digital subtracted angiography has undergone significant advances, becoming an essential tool for precise localization and mapping of the anatomy of the AAK in the preoperative period. This technique allows to accurately determine the origin level and laterality of the artery, fundamental information for surgical planning.

The literature highlights that, because it originates from the lumbar arteries, AAK requires special attention regarding the preservation of blood flow from these structures during the planning of thoracic abdominal repairs. Simultaneous or prior interventions in the abdominal aorta, associated with extensive exclusion of the thoracic aorta, significantly increase the risk of paraplegia.[4] Interruption of multiple intercostal and lumbar arteries may compromise the collateral supply, making the spinal cord especially susceptible to ischemic lesions in situations of arterial hypotension or low heart rate.[1]

It is highlighted that the arterial irrigation of the lower portion of the spinal cord is supported by a vascular network consisting of a single ventral trunk and two dorsolateral trunks, interconnected by sacral anastomosis. In situations of chronic ischemia, prolonged periods of adaptation favor the development of an effective collateral circulation, especially through the dorsolateral spinal arteries. On the other hand, episodes of acute hyperperfusion, particularly involving the anterior radiculomedullary artery, which is ventrally located, may trigger serious ischemic complications such as paraparesis or paraplegia.[9,10]

The neurological impairment after endoscopic surgery represents a serious complication, mainly due to the risk of damage to the vascular supply of the spinal cord. Previous studies indicate that the incidence of paraplegia and paraparesis after these procedures can reach up to 11.3%. In research conducted by Puertas et al. (1998)[14], it was observed that 4% of patients undergoing the correction of idiopathic scoliosis, by means of instrumentation and posterior arthrodesis, developed permanent neurological lesions. AAK is one of the main sources of irrigation of the spinal cord, especially between T8 levels and the spinal cord cone.

Although AAK visualization is widely documented in countries in Europe, North America and Asia, its identification may present significant regional variations. Specifically, there is a shortage of studies that thoroughly investigate the location of AAK in Latin American populations.[15] Therefore, data from previous studies should be interpreted with caution as they are not always directly applicable to all populations.[16]

Another relevant aspect is the distinction between the AAK and the anterior radiculomedullary vein, since confusion between these vessels can result in serious surgical complications.[18] The anterior radiculomedullary vein may present a morphology and trajectory similar to those of the AAK, which makes its differentiation especially challenging.[18] To minimize errors, it is recommended to adopt a strict injection and scanning protocol, starting the examination seven seconds after contrast reaches 180 Hounsfield units in dynamic image reconstruction. Segundo Utsunomiya et al. (2008)[19], protocols with high concentration of iodine and high flow demonstrate effectiveness in the identification of AAK. In addition, the anterior radiculomedullary vein tends to present a more winding path, a feature that can help in its distinction from the artery.

CONCLUSION

The in-depth mastery of spinal anatomy, especially AAK, is fundamental for the safety and effectiveness of surgical interventions in the spine. The preservation of this critical structure is directly associated with the reduction of serious neurological complications, such as paraplegia, as evidenced by the literature. Given the considerable anatomical variability between individuals and population groups, it becomes imperative to carry out a rigorous preoperative evaluation, with the help of advanced imaging techniques. The routine adoption of these resources in clinical practice, coupled with continued training of health professionals, significantly contributes to the improvement of surgical outcomes and to the prevention of irreversible lesions to the spinal cord. Thus, investment in anatomical knowledge, diagnostic technology and professional training should be considered an essential pillar in the planning of endoscopic procedures of the spine.

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CONFLICT OF INTEREST

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

CONTRIBUTIONS OF THE AUTHORS

Each author contributed individually and significantly to the development of this article. RHF, DFG, CML: conceptualization, investigation, writing – original draft; TQS, AFL, ADM: validation, supervision; SEL, JPMB: formal analysis, writing – review and editing.

DATA AVAILABILITY DECLARATION

The contents underlying the research are available in the manuscript.

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