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# Management of vertebral artery injury in anterior cervical spine surgery. Technical note and considerations

## *Manejo de la lesión de la arteria vertebral en cirugía de la columna cervical anterior. Nota técnica y consideraciones*

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### Keywords:

vertebral artery, iatrogenic  
injury, vertebral artery injury,  
tamponade, hemostasia.

### Palabras clave:

arteria vertebral, lesión  
iatrogénica, lesión de  
la arteria vertebral,  
taponamiento, hemostasia.

### ABSTRACT

The overall incidence of iatrogenic vertebral artery injury (IVAI) in cervical spine surgeries is reported to be 0.07-1.4% and can cause life threatening complications such as arteriovenous fistulas, catastrophic bleeding, neurological impairment, cerebral ischemia, and death. Techniques used for the primary control of bleeding include muscle patch, primary closure with vascular suturing and endovascular management. We report the technique used to control bleeding of a vertebral artery injury.

### RESUMEN

Se informa que la incidencia general de la lesión iatrogénica de la arteria vertebral en cirugías de la columna cervical es de 0.07-1.4% y puede causar complicaciones potencialmente mortales, como fistulas arteriovenosas, sangrado catastrófico, deterioro neurológico, isquemia cerebral y muerte. Las técnicas utilizadas para el control primario del sangrado incluyen parche muscular, cierre primario con sutura vascular y manejo endovascular. Informamos sobre la técnica utilizada para controlar el sangrado de una lesión de la arteria vertebral.

### Abbreviations:

ACDF = anterior cervical decompression and fusion  
CT = computed tomography  
IVAI = iatrogenic vertebral artery injury  
MRI = magnetic resonance imaging  
VA = vertebral artery  
VAI = vertebral artery injury

### INTRODUCTION

The anterior cervical approach was described by Smith Robinson in 1958 and it is the first approach used for anterior spinal surgery. The advantages of this approach

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are the exposure of multiple cervical levels, neural decompression, and reconstruction of cervical anatomy.<sup>1</sup>

The incidence of iatrogenic vertebral artery injury (IVAI) after cervical spine surgeries are reported to be from 0.07-1.4% and can cause devastating complications as dysphagia, recurrent laryngeal nerve palsy, Horner syndrome, and esophageal perforation, arteriovenous fistulas, catastrophic bleeding, neurological impairment, cerebral ischemia, and death.<sup>2,3</sup>

Most studies reported the IVAI occurred during the exposure of anterior cervical approaches (corpectomy or fusion), screw fixation of dens fracture and resection of spine tumors. The most frequently involved vessel is the VA.<sup>4,5</sup> Techniques used for the primary control of bleeding and management of VAI include muscle patches, primary closure, hemostatic tamponade, microvascular repair or anastomosis, endovascular management, and ligation of the VA.<sup>2</sup>

We report a case of IVAI during a spinal surgery in a ACDF approach, and we propose a simple technique to control the primary bleeding of vertebral artery only using hemostatic gelatin for tamponade.

### CASE REPORT

A 78-year-old female with no comorbidities has a history of six months of cervical pain with bilateral irradiation to shoulders and weakness in both arms.

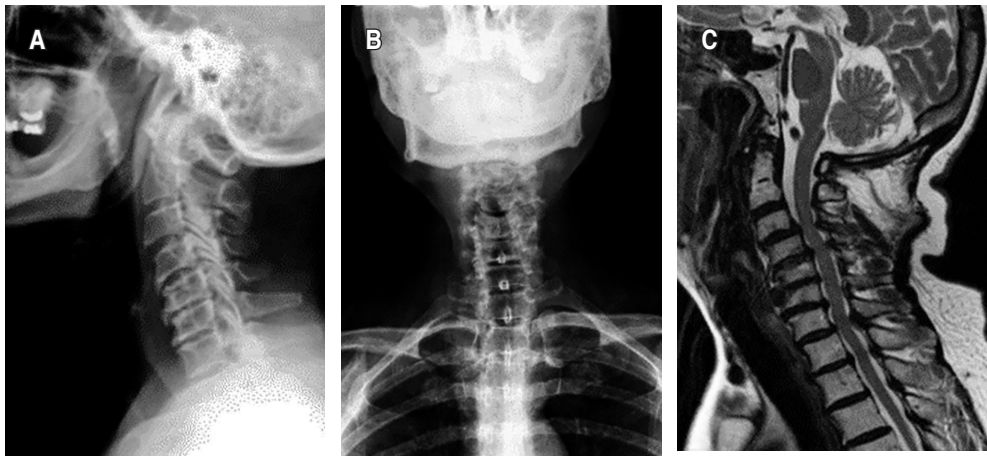
Cervical radiography showed spondylarthrosis changes, most prominently in C3-C4, C4-C5, anterior

osteophytic complex. Magnetic resonance imaging of cervical spine shows decrease of interbody space in C3-C4, C4-C5, C5-C6 (*Figure 1*). Electromyography of the patient was compatible to cervical radiculopathy (levels C4-C5, C5-C6).

An anterior cervical decompression and arthrodesis with interbody implant with two body screw both levels (C3-C4, C4-C5) was made. During the drilling of the posterior osteophytic complex we observed a site of bleeding and starts the maneuver to control vertebral artery injury.

### Surgical control technique

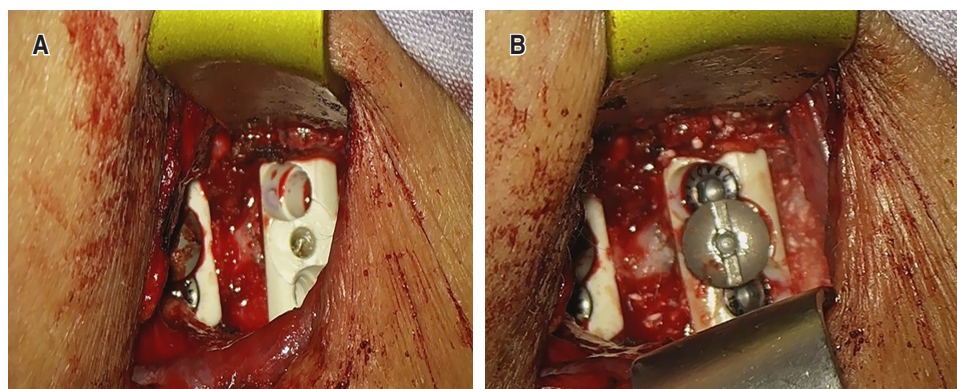
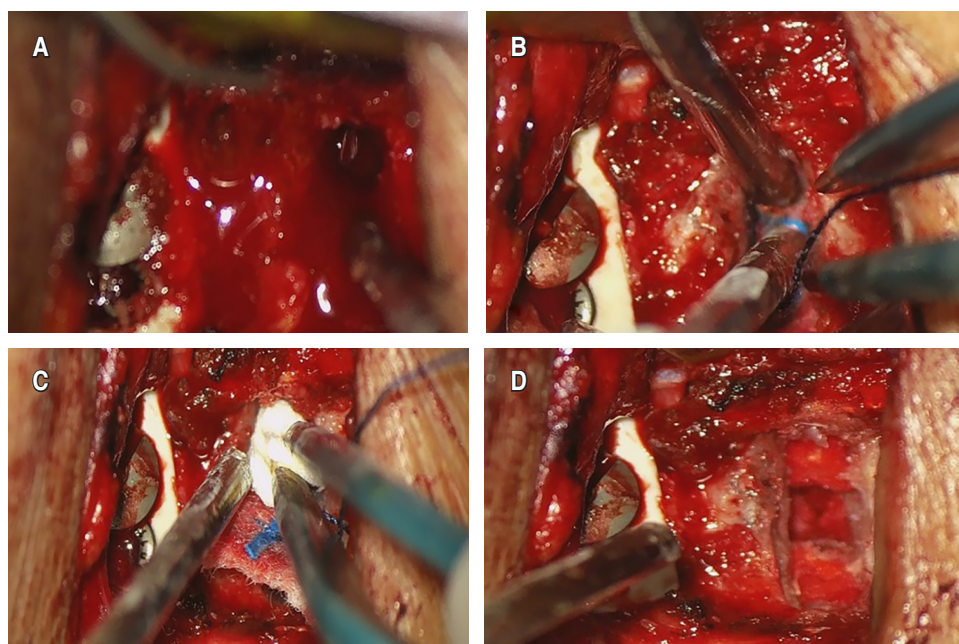
1. Identify the side or segment of the vertebral artery injury most cases are close to the foramina (*Figure 1A*).
2. Place surgical patties on each foramina side and apply gentle compression for bleeding control (*Figure 1B*).
3. Change the surgical patties as many times is necessary to tamponade/packing the primary site of bleeding and reduce the flow.
4. Irrigation with warm sterile solution (approximately 50 cm<sup>3</sup>).
5. Place absorbable hemostatic gelatin sponge 1.5 × 0.8 centimeters packed and sized of intervertebral space on each foramen (*Figure 1C*).
6. Remove the surgical patties and place a second stripe of absorbable hemostatic gelatin sponge.



**Figure 1:** **A)** Lateral X-ray image, anterior osteophytes at all cervical levels, decreased height of the vertebral bodies, especially C4-C5, C5-C6, C6-C7, with generalized rectification. **B)** Anteroposterior X-ray image shows bone changes in relation to degenerative cervical spondylosis. **C)** Magnetic resonance imaging sagittal T2 weighted image, shows collapse and instability data, also anterior compression of spine at C4-C5, C5-C6, C6-C7 is seen.

**Figure 2:**

Surgical control technique.  
**A)** Latrogenic vertebral artery injury during the surgical procedure (ADCF).  
**B)** Hemorrhage control placing small surgical patties.  
**C)** Place absorbable hemostatic gelatin for tamponade.  
**D)** Verify the bleeding hemostatic control.



**Figure 3:**

Anterior discectomy and cervical fusion. **A)** After the hemostasia, place the cervical disc implant with no mechanical distraction. **B)** Set the cervical system and block it.

7. Do not move the absorbable hemostatic gelatin sponge and put the cervical implant without vertebral distraction for separate interbody space (Figure 2).

After the hemostasia control, the reported bleeding was 300 cm<sup>3</sup>, there were no more eventualities nor complications during the surgical procedure. At the end of the procedure, the patient was extubated, pupilar response was without alteration and she moved her four extremities. During the hospitalization, the patient did not complain of dysphagia or dysphonia. She was discharged after three days of hospitalization (one inside intensive care unit and two on standard hospital stay (Figure 3).

At the three month follow up the angio-tomography does not show a pseudoaneurysm or another alteration of vertebral injury (Figure 4).

### Landmarks to avoid vertebral injury

*Middle line:* the middle line in cervical spine surgery is important, this reference can be traced at the middle distance of the insertion of both longus colli.

*Longus colli dissection:* the lateral limit of longus colli dissection is an important anatomical reference. The incision of the longus colli must be done transversally starting at the vertebral body and extending approximately 4-6 millimeters laterally. An extension larger than six millimeters increases the risk of vertebral artery injury.

*Limits of interbody discectomy:* lateral limits of discectomy may be considered at the Luschka joint, if the osteophytic complex is larger the extension should not be greater than the lateral foramen.

## DISCUSSION

Inadvertent injuring of tissue during complicated surgical procedures is inevitable in some cases. Vertebral artery damage is a rare complication; the difficulties after the tearing of tissue can be life-threatening.<sup>6</sup> When there is damage to the vertebral artery, the neurosurgeon must have knowledge of the surgical technique to control bleeding and be able to avoid life-threatening complications. Here, we presented a simple method to control the bleeding after an iatrogenic vertebral artery injury during ACDF.

All the authors agree on the need to accomplish the local control of hemorrhage, preventing the vertebrobasilar ischemia and the cerebrovascular embolies, during the VAI reparation techniques.<sup>7</sup> Even if there is still no agreement for definitive treatment strategy of VAI,<sup>8</sup> the current literature coincides that, the first maneuver to control bleeding during VAI should be via direct tamponade with hemostatic agents (Gelfoam, Surgicel, or FloSeal) or bonewax.<sup>9</sup> Lunardini, et al.<sup>10</sup> reported an incidence of tamponade as primary management after IVAI in 76.8% of cases. In the other hand, Golfinos, et al.<sup>7</sup> promoted for the clean ligation or vascular repair as second choice of treatment. However, sponsored the primary vascular repair thought anastomosis “whenever possible”.<sup>7</sup>

In the present case report, we described the application of hemostatic gelatin for a vertebral artery bleed achieving hemostasis after applying pressure for 5 min. There was no need to perform a vascular repair of VA after the primary control.

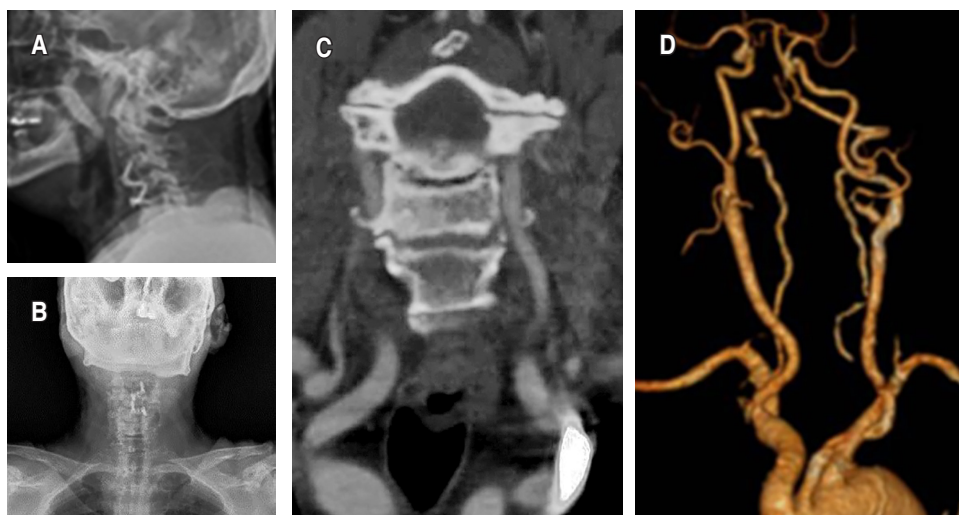
Yi<sup>9</sup> explains that the bleeding control by direct hemostatic tamponade can be effective, but this technique has several disadvantages as the delayed hemorrhage or ischemia due to the formation of pseudo-aneurysm or AVF. In this case, we found no late complications after three months of follow up.

The current case report confirms the tamponade technique utility during surgery. The hemostatic gelatin patch provided a rapid, effective, and noninvasive method of hemostasis in this single patient. The hemostatic gelatin does not need prior preparation nor special storage, and this allows rapid availability during the surgery.

## CONCLUSIONS

Vertebral artery injury is a preventable life-threatening complication in anterior cervical approaches. It is important to know the landmarks to avoid vertebral artery injury. The identification of anatomical structures and anatomical limits is important to prevent damage to the vertebral artery. Identification of the midline should be used as the median distance between both longus colli and maintain this anatomical relationship.

Recognition of Luschka articulation should be used as a lateral limit of posterior osteophytic resection. The dissection of the longus colli should not extend more than 4-6 mm as a safety limit.



**Figure 4:**

**A-B)** Postoperative X-rays. The cervical disc implants are observed in situ. **C)** Angio computed tomography, coronal view, there is no evidence of vertebral artery injury or sequelae. **D)** 3D reconstruction, vascular system with no evidence of lesions (pseudoaneurysm or fistula).

When primary repair was not possible the hemostatic gelatin patch provided an excellent hemorrhage control system and no postoperative complications due to bleeding.

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