Indocyanine Green Videoangiography in Negative: Spinal Dural Arteriovenous Fistula

Juan Antonio Simal Julián¹ Pablo Miranda Lloret¹ Pablo Sanromán Álvarez¹ Laila Pérez de San Román¹
Andrés Beltrán Giner¹ Carlos Botella Asunción¹

¹Neurosurgical Department, HUyP La Fe de Valencia, Valencia, Spain

Address for correspondence J. A. Simal Julián, MD, Hospital La Fe, Blv Sur S/N, Valencia, Spain (e-mail: juanantonio.simal@gmail.com).

Global Spine J 2015;5:e5–e6.

Abstract

Introduction This work reports the first indocyanine green videoangiography (IGV) in negative published with video format support. This technique, so called because its first phase is performed with occlusion of the vessel suspected of being pathologic, is used for the diagnosis of spinal arteriovenous fistula (sDAVF).

Case Report The authors present the case of a 68-year-old man with an sDAVF fed by the right T7 segmentary artery. IGV was initially performed with the presumptive fistula feeder occluded for less than 1 minute, which provided both diagnostic and post-exclusion control in one procedure. This technique therefore is reversible by not prolonging vascular exclusion times.

Discussion IGV in negative is an extremely visual and intuitive procedure that represents an improvement over conventional IGV.

Conclusion Studies with larger sample sizes are necessary to determine whether IGV in negative can further reduce the need for postoperative digital subtraction angiography.

Keywords

- indocyanine green
- videoangiography
- dural arteriovenous fistula

Introduction

Indocyanine green videoangiography (IGV) in negative, so called because its first phase is performed with occlusion of the vessel suspected of being pathological, has been defined in spinal and intracranial dural arteriovenous fistula.^{1,2} In the present work, the authors show the first case of IGV in negative published with video support, which was used for the diagnosis of a spinal arteriovenous fistula (sDAVF). This procedure avoids some of the limitations of conventional IGV and facilitates its interpretation.³

Case Report

A 68-year-old man had acute paraparesis and sphincter control disturbances. T2-weighted magnetic resonance imaging showed intramedullary hyperintensity and flow voids within the spinal canal. Selective spinal digital subtraction angiography (DSA) confirmed the diagnosis of sDAVF, fed by

the right T7 segmentary artery (► **Fig. 1**). The surgical treatment (► **Video 1**) was performed in the prone position under general anesthesia, with monitoring by motor evoked potentials. After patient consent was obtained, a T7 right hemilaminectomy and midline durotomy were performed. The right-sided T7 nerve root and arterial periradicular network were identified extradurally. Intradurally, we observed a vein that hung from the dura mater, which drained into a serpiginous and dilated venous network. This venous vessel with suspected arterialization was temporarily clipped. Some seconds after the clipping, an IGV in negative was performed, with intravenous administration of a bolus of 25-mg ICG diluted in 5 mL under a Pentero surgical microscope (Carl Zeiss Co., Oberkochen, Germany). During the first phase, filling of the venous and arterial medullary vessels was observed, but no filling was seen in the serpiginous venous network. In the second phase (1 minute after the administration of ICG), after the removal of the temporary clip, rapid

received
January 23, 2014
accepted after revision
September 15, 2014
published online
October 29, 2014

DOI <http://dx.doi.org/10.1055/s-0034-1394361>.
ISSN 2192-5682.

© 2015 Georg Thieme Verlag KG
Stuttgart · New York

License terms

Fig. 1 (A) Sagittal T2-weighted magnetic resonance imaging showed intramedullary hyperintensity (arrowhead) and flow voids (arrow) in the spinal canal. (B) Digital subtraction angiography showing a spinal arteriovenous fistula fed by the right T7 segmentary artery.

filling of the serpiginous venous network was observed, which is typical of sDAVF. After this vessel was identified as pathological, we proceeded to perform coagulation and cutting, with subsequent darkening of the serpiginous venous network on imaging. During intraoperative monitoring, no changes were observed. The patient experienced a significant motor improvement. Immediate postoperative DSA ruled out the existence of dural arteriovenous fistulae.

Video 1

Indocyanine green videoangiography in negative in a spinal dural arteriovenous fistula.
Online content including video sequences viewable at:
www.thieme-connect.com/products/ejournals/html/10.1055/s-0034-1394361.

Discussion

IGV in negative has been developed for the diagnosis of spinal and intracranial dural arteriovenous fistulae.^{1,2} Conventional IGV involves the intravenous administration of indocyanine green. Subsequently, vascular filling is visualized using specific optical systems that are integrated in current surgical microscopes. IGV has primarily been compared with intraoperative arteriography,⁴ which is the gold standard in the context of neurovascular pathology. The fundamental limitations of IGV are that the vascular structures to be analyzed must be exposed within the surgical field. As a result, blood vessels that are blocked by a clot, atheroma, or brain parenchyma, as well as blind angles, are invisible using this technique. In the case presented, negative IGV as applied to

the sDAVF provided both diagnostic and postexclusion control in a single procedure that took less than 1 minute.⁵ Reversibility was enabled by the shortened vascular exclusion time. Conversely, conventional IGV comprises two procedures, one for diagnosis and one for the postexclusion control. Conventional IGV often requires repeated visualizations, which makes the procedure longer and more difficult to perform.

IGV in negative is an extremely visual and intuitive procedure, and, more importantly, it is reversible and avoids repeated IGV visualizations and other complex intraoperative procedures.⁴ The procedure excludes the possible presence of multiple shunts in cases where there is filling of the arterialized venous system after transient occlusion. Additionally, this procedure can be performed with minimally invasive approaches as only a short durotomy and microscope view are required.

Conclusion

In conclusion, IGV in negative is an improvement over conventional IGV methods, as the technique can provide more information in a shorter period of time and in a more intuitive way.² Studies with larger samples will be necessary to determine whether IGV in negative can further reduce the need for postoperative DSA.

Disclosures

Juan Antonio Simal Julián, none
Pablo Miranda Lloret, none
Pablo Sanromán Álvarez, none
Laila Pérez de San Román, none
Andrés Beltrán Giner, none
Carlos Botella Asunción, none

References

- 1 Simal Julián JA, Miranda Lloret P, Aparici Robles F, Beltrán Giner A, Botella Asunción C. Indocyanine green videoangiography "in negative": definition and usefulness in intracranial dural arteriovenous fistulae. *Neurosurgery* 2013;73:ons86-ons92
- 2 Simal Julián JA, Miranda Lloret P, López González A, Evangelista Zamora R, Botella Asunción C. Indocyanine green videoangiography "in negative": definition and usefulness in spinal dural arteriovenous fistulae. *Eur Spine J* 2013;22(Suppl 3):S471-S477
- 3 Hanel RA, Nakaji P, Spetzler RF. Use of microscope-integrated near-infrared indocyanine green videoangiography in the surgical treatment of spinal dural arteriovenous fistulae. *Neurosurgery* 2010;66(5):978-984, discussion 984-985
- 4 Schievink WI, Vishteh AG, McDougall CG, Spetzler RF. Intraoperative spinal angiography. *J Neurosurg* 1999;90(1, Suppl):48-51
- 5 Spetzler RF, Detwiler PW, Riina HA, Porter RW. Modified classification of spinal cord vascular lesions. *J Neurosurg* 2002;96(2, Suppl):145-156