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*Case Report*

# Utility of intraoperative fluorescence imaging with indocyanine green for diagnosing spinal schwannoma: A case report

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## ABSTRACT

**Background:** The delayed-window indocyanine green (DWICG) technique is useful for the removal of brain and spinal tumors.

**Case Description:** A 41-year-old female presented with lower left back and radicular pain. An magnetic resonance imaging (MRI) revealed an extramedullary L3 lesion located ventrally in the spinal canal that appeared to be a schwannoma. Intravenous indocyanine green (dose, 0.25 mg/kg) was administered 1 h before the L2–L4 laminectomy and L3/L4 posterior lumbar fusion. At surgery utilizing a strong near-infrared (NIR) signal, the tumor was clearly visualized through the dura. Complete tumor excision was confirmed when the NIR signal could no longer be detected. Pathologically, the lesion proved to be a schwannoma. A postoperative MRI scan further confirmed complete tumor excision.

**Conclusion:** In a 41-year-old female, the DWICG technique intraoperatively facilitated localization of a L3 schwannoma through the dura and expedited gross total tumor removal.

**Keywords:** Indocyanine green, Near-infrared fluorescence, Schwannoma, Spine

## INTRODUCTION

Indocyanine green (ICG) videoangiography provides real-time images intraoperatively for assessing central nervous system tumors.[1,2,9,11] The second window ICG (SWICG) and delayed-window ICG (DWICG) techniques have been successfully used intraoperatively for removing brain tumors, leading us to anticipate that they should similarly prove useful for intraoperative localization and excision of spinal tumors.[3-8,10] Here, in a 41-year-old female, we used the DWICG technique to locate and confirm gross total L3 ventral schwannoma removal.

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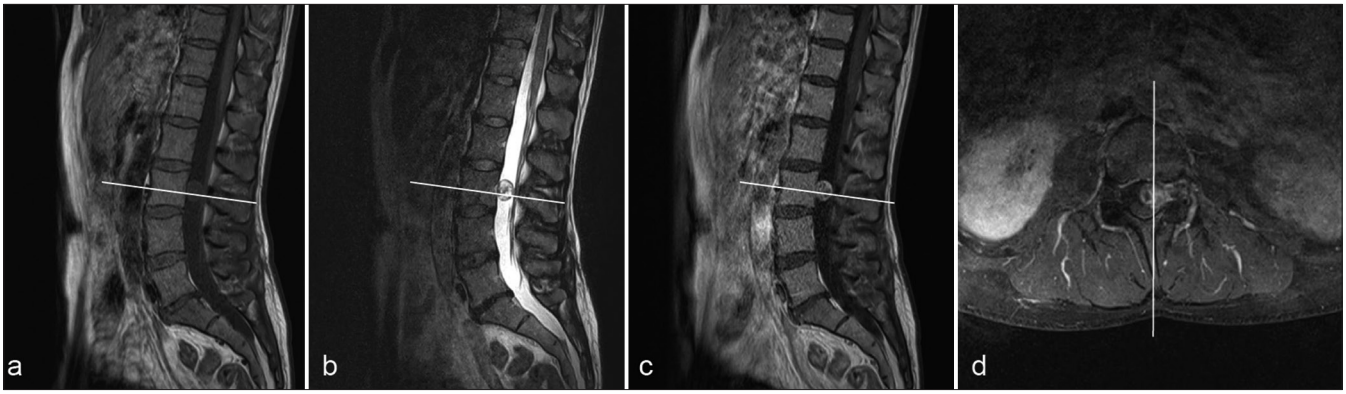


**Figure 1:** Preoperative magnetic resonance images. (a and b) Sagittal T1-weighted and T2-weighted images show an extramedullary lesion, which is located ventrally in the spinal canal. (c and d) Sagittal and axial contrast-enhanced T1-weighted images show a contrast-enhancing lesion with heterogeneity, which is slightly protruding into the left intervertebral foramen at L3–4. Figures a-c are at the level of the white line in Figure d. Figure d is at the level of the white line in figures a-c.

## CASE DESCRIPTION

A 41-year-old female patient presented with left lower back and radicular pain (i.e., L5 distribution). The lumbar magnetic resonance (MR) revealed a ventral, extramedullary lesion at the L3 level with foraminal extension; it was isointense on T1/mixed intensity on the T2WI and markedly heterogeneously enhanced with contrast [Figure 1]. Next, ICG was administered intravenously at a dose of 0.25 mg/kg approximately 1 h before exposing the dura mater. When dura was exposed following the L2-L4 laminectomy, DWICG imaging produced a strong signal on near-infrared (NIR) that readily localized the L3 tumor and its left foraminal extension [Figure 2]. The tumor was later documented to be a schwannoma, originating from the left L3 root. Complete excision was later confirmed by NIR imaging. A L3/L4 posterior lumbar fusion followed. The postoperative MR imaging also subsequently documented gross total tumor excision [Figure 3].

## DISCUSSION

Recently, ICG video angiography has been used intraoperatively in neuorsurgery to provide real-time brain and spine tumor images; specifically, the SWICG and DWICG techniques facilitate brain and spinal tumor removal.[1-11] Notably, the intensity of gadolinium-enhanced T1 tumor signals correlates well with NIR fluorescence signals.[8] The fluorescence of signals coming from tumors using DWICG is attributed to leakage of ICG from blood–brain barrier-damaged blood vessels surrounding and/or within the tumor. Two cases of patients who successfully underwent NIR imaging using the DWICG for spinal schwannomas were previously reported.[7] Here, we discuss the effectiveness of DWICG in facilitating transdural localization and excision of an L3 spinal schwannoma [Table 1].

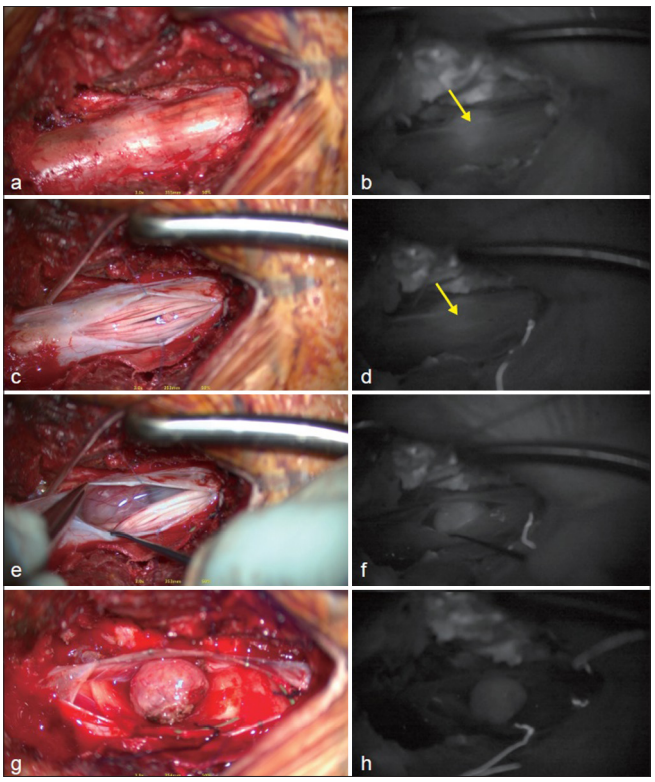


**Figure 2:** Intraoperative images through a microscope. (a) An image of exposed dura mater following laminectomy at L2–3 and L3–4. (b) A near-infrared fluorescence image of Figure a. A strong near-infrared (NIR) signal is shown through the dura mater. A yellow arrow indicates the NIR signal. (c) An image showing the opened dura mater and exposed caudal equina nerves. (d) A near-infrared fluorescence image of figure c. A yellow arrow indicates the NIR signal. (e) An image showing the exposed tumor and retracted caudal equina nerves. (f) A near-infrared fluorescence image of figure e. A strong NIR signal is shown from the tumor. (g) An image is shown just before the tumor is completely removed. (h) A near-infrared fluorescence image of Figure g.

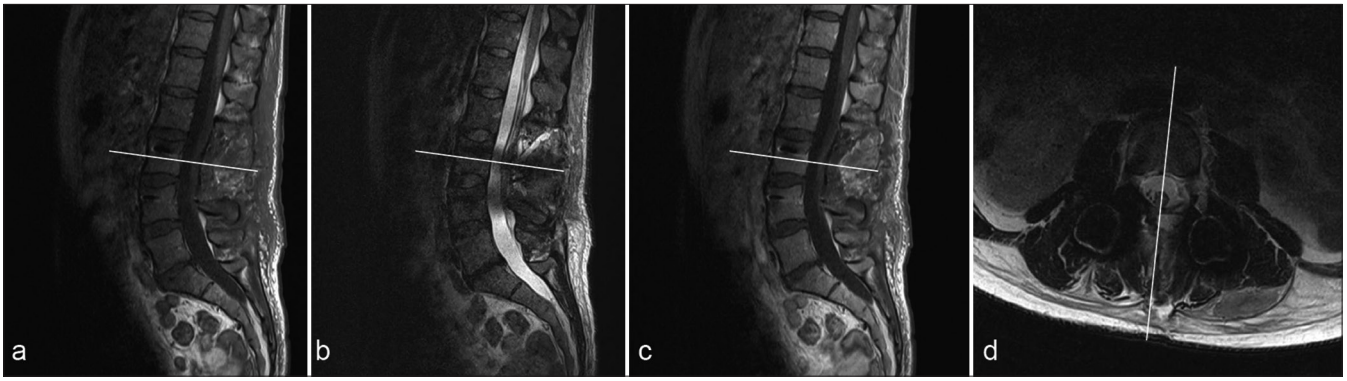


**Figure 3:** Postoperative magnetic resonance images. (a-d) Sagittal T1-weighted, sagittal and axial T2-weighted, and sagittal contrast-enhanced T1-weighted images show no residual lesion. Figures a-c are at the level of the white line in Figure d. Figure d is at the level of the white line in Figures a-c.

**Table 1:** Summary of cases using delayed-window indocyanine green for a spinal schwannoma.

| Author, (Reference), journal, and year | Number of patients | Pathology | Location | Detection through durar | The extent of tumor resection |
|---|---|---|---|---|---|
| Muto *et al*.[7] Neurosurg | 1st Case | Schwannoma | Dorsal side at C1/2 level | Good | Total |
| Focus Video 2022 | 2nd Case | Schwannoma | Dorsal side between C6 and T2 | Weak | Total |
| Present case | 1 Case | Schwannoma | Ventral side at L3 level | Good | Total |

## CONCLUSION

Following an L2-L4 laminectomy, a lumbar spinal L3 ventral schwannoma was effectively visualized through the dura using the DWICG technique, facilitating gross total tumor excision.

### Ethical approval

The research/study was approved by the Institutional Review Board at Kyoto Katsura Hospital, number 2024-49, dated August 26, 2024.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflicts of interest.

### Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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