

# Successful laparoscopic resection and repair of the obturator nerve using nerve regeneration induction tube: A case report

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## Abstract

A nerve regeneration induction tube (Nerbridge®) was approved in Japan in 2013 as the first domestic medical device for promoting the regeneration of peripheral nerves torn or lost due to trauma. Although there have been reports on laparoscopic obturator nerve repair, all of these have involved autologous nerve grafting or end-to-end anastomosis, with no reports of nerve repair using nerve regeneration induction tube.

We report our experience using the nerve regeneration induction tube for nerve reconstruction after resection of the obturator lymph nodes and obturator nerve during laparoscopic radical hysterectomy for cervical cancer, which resulted in a positive postoperative course.

**Keywords:** obturator nerve, laparoscopic repair, lymph node metastasis, nerve regeneration induction tube

## Introduction

A nerve regeneration induction tube (Nerbridge®) was approved in Japan in 2013 as the first domestic medical device for promoting the regeneration of peripheral nerves torn or lost due to trauma. The safety and effectiveness of this neuroregeneration device is recognized because, unlike therapies such as autotransplantation, it does not require harvesting a nerve from a healthy area of the patient, which reduces the burden on the patient.

The nerve regeneration induction tube is a polyglycolic acid tube filled with collagen, which provides the scaffold for promoting nerve extension inside the tube. Autologous nerve regeneration and extension is induced from the central to peripheral side to restore function. The polyglycolic acid and collagen decompose, are absorbed by the body, and disappear after about 3 months of nerve regeneration.

The device is mainly used in orthopedic surgery and at the clinical trial stage exhibited favorable therapeutic outcomes, with an efficacy rate of 82.2%.

As a contribution to the literature, we report our experience using the nerve regeneration induction tube for nerve reconstruction after resection of the obturator lymph nodes and obturator nerve during laparoscopic radical hysterectomy for cervical cancer, which resulted in a positive postoperative course.

## Case

The patient was a 36-year-old woman, unigravida and unipara, no notable medical history, height 159.7 cm, weight 48.5 kg.

Severe cervical dysplasia was observed during a regular check-up, for which a previous physician performed conization. The pathological findings showed a tumor 18 mm in the horizontal direction with a depth of 5.1 mm and positive for lymphatic invasion. The histological type was squamous cell carcinoma and the patient was referred to our hospital with a diagnosis of cervical cancer stage IB1.

Transvaginal ultrasonography and MRI performed at our hospital showed no obvious residual lesions in the cervical region, and cytology was Negative for intraepithelial lesion/malignancy (NILM). Computed tomography showed enlarged lymph nodes in the right common iliac region, but no other signs of distant metastasis. In addition, although SCC was high at 1.8 ng/ml, CEA, CA125, and CA19-9 were not elevated. Based on the above, we performed sentinel lymph node biopsy + laparoscopic radical hysterectomy + bilateral adnexectomy.

## Procedure

After creating the vaginal cuff, the patient was placed in the lithotomy position with the pelvis elevated 10°. Laparoscopic surgery was performed with the trocars arranged in a 5-port diamond configuration + upper-right abdomen.

The right sentinel lymph node was an obturator node, enlarged to about 15 mm and firmly adhered to the obturator nerve.

Due to the high likelihood of lymph node metastasis, the sentinel lymph node was resected together with the obturator nerve and submitted for rapid pathological testing.

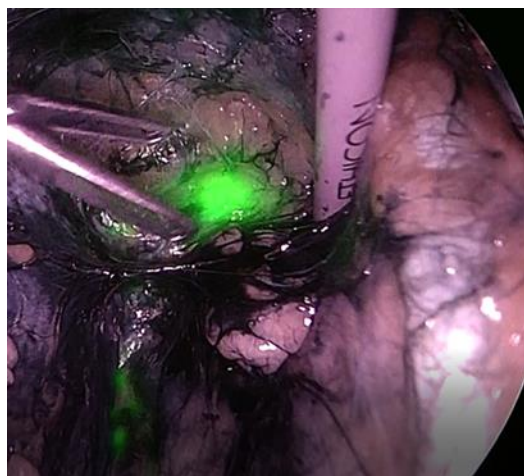
The sentinel lymph node was similarly identified on the left side. On the left, an external iliac lymph node was about 8 mm with no adhesions to the surrounding area. Rapid pathology was positive on the right side.

We transitioned to pelvic lymph node dissection of the external iliac, internal iliac, and obturator lymph nodes. After removing the uterus, dissection of the paraaortic lymph nodes biopsy was added. Lymph nodes were removed en bloc and collected via the 12 mm port using EZ Pass® (Hakko Medical Device Division). The blood vessels around the uterus were dissected after being clipped with the usual method, the various ligaments were dissected, and Douglas' pouch and the peritoneum were incised to expose the hypogastric nerve. The anterior and posterior layers of the vesicouterine ligament were treated while preserving the bladder branch of the pelvic plexus. The vaginal canal was incised and the uterus and bilateral adnexa were placed in the EZ Pass® and removed transvaginally. The vaginal wall was closed with a single 0-Vicryl® suture.

Next we transitioned to nerve repair. An intraoperative consultation was held for plastic surgery and the deficit was confirmed. The deficit was about 30 mm long, which seemed difficult to address with end-to-end anastomosis. Following the method of Mackinnon et al. [1], the central and peripheral nerve stumps were pulled about 2 mm into a 4.0-mm nerve regeneration induction tube that had been immersed in saline. The distal and proximal ends were sutured with 3 stitches each using 4-0 Prolene®. Care was taken during the repair not to place tension on the nerve.

The operation lasted 7 hours 4 minutes and the amount of bleeding was 550 ml. On postoperative day 3, the patient had no problems moving the right lower limb. On postoperative day 6, she could walk without any problems, she was discharged from the hospital on postoperative day 7.

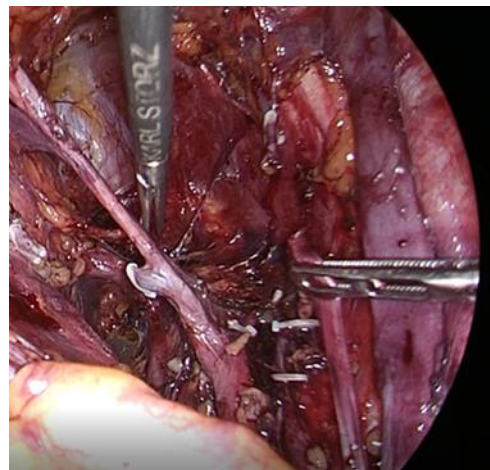
Chemoradiotherapy was initiated on postoperative day 44. The entire pelvis and paraaortic lymph nodes were irradiated with 45 Gy/25 fr and weekly cisplatin 40 mg/m<sup>2</sup> was administered simultaneously. Treatment finished without any severe side effects.



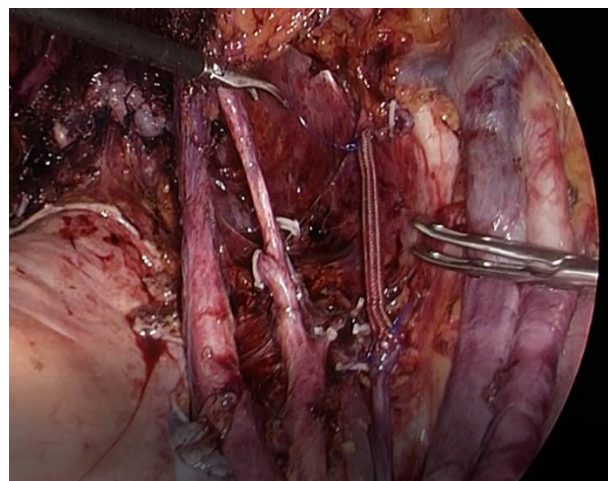
**Figure 1.** The right sentinel lymph node (obturator node)

Three months after the operation lymphedema was observed in the lower abdomen and thigh area, but this improved with physical therapy.

No recurrence was observed at 15 months postoperatively. The Semmes-Weinstein (SW) test of the obturator nerve region of the right lower limb was palpable to 2.36 (0.2 g) on both sides, and the distribution was clearly abnormal. And the entire range was palpable. A neurology consultation revealed right leg strength of 5/5 in flexion, 4/5 in adduction, 5/5 in abduction, 5/5 in external rotation and 4/5 inner rotation.



**Figure 2.** The sentinel lymph node resection with the obturator nerve



**Figure 3.** The Obturator nerve repair

## Discussion

Autologous nerve grafts had been the main therapy in Japan to treat nerve deficits after trauma or tumor removal, but in 1990, the clinical application of an artificial tube made from absorbable polyglycolic acid was reported in the United States as an alternative to autologous nerve grafting [1]. This device was approved by the FDA in 1999 and released on the market. Since then, it and other similar products have become widely used around the world. The Nerbridge® was first approved in Japan in 2013. The structure of the nerve regeneration induction tube is a PGA tube filled with collagen, with the tube's outer surface also coated with collagen. The tubes are about 55 mm long and come in 8 widths, with inner diameters of 0.5-4.0 mm at 0.5 mm intervals. The biggest advantages of artificial nerve tubes are that,

unlike autologous nerve grafting, the procedure is shorter because nerve harvesting is unnecessary, which also eliminates sensory disorders at the harvest site. The efficacy rate at the trial stage before approval was good at 82.8%. Efficacy and safety have not been confirmed when the length of the nerve deficit exceeds 40 mm.

In the present case, the deficit was thought to be about 30 mm long. Generally, the obturator nerve is about 2.0 to 3.0 mm thick, which is considered to be a good indication for artificial nerve repair.

The maximum reported nerve gap for which nerve regeneration-inducing tubes have actually been effective is currently 38 mm in humans, though according to Agnew et al. many articles recommend it for neurological deficits up to 30 mm [2]. Limitations on the length of nerve-induction tubes will need to be examined in the future.

Although there have been reports on laparoscopic obturator nerve repair [3,4], all of these have involved autologous nerve grafting or end-to-end anastomosis, with no reports of nerve repair using nerve regeneration induction tube.

When suturing nerves, it is important to properly confirm the central and peripheral stumps and join them in a tension-free manner. And an important factor in nerve regeneration is blood flow to the regenerated nerve [5-8].

Because the obturator nerve is not very mobile, lengthy deficits may require a nerve graft. However, nerve grafts can result in sensory disorders at the nerve harvest site, and harvesting a nerve takes time. Using an artificial nerve is considered effective because it eliminates the risk of sensory disturbance and the time required for nerve harvest.

When performing pelvic lymph node dissection, if the lymph nodes and obturator nerve are firmly adhered such as in the present case, or if the obturator nerve is severed accidentally, repair with an artificial nerve can be effective. If the procedure can be repaired laparoscopically it is minimally invasive, making it a useful therapeutic option.

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