Technical Note

Nerve-Preserving Endoscopically Assisted Resection of Schwannoma of the Radial Nerve

Tun Hing Lui, M.B.B.S.(HK), F.R.C.S.(Edin), F.H.K.A.M., F.H.K.C.O.S., and Churk Hang Charles Li, M.B.Ch.B., M.R.C.S.(HK), F.R.C.S.Ed.(Ortho), F.H.K.C.O.S., F.H.K.A.M.(Ortho)

Abstract: Schwannomas are the most common peripheral nerve tumors; they can present as painful masses or paresthesia. The aim of surgical treatment of a symptomatic schwannoma is total to gross total excision of the tumor along with preservation of the affected nerve and its function, particularly in patients with conserved functionality of a major nerve trunk. This Technical Note describes the technical details of nerve-preserving endoscopically assisted resection of a schwannoma of the radial nerve. This is an intracapsular resection of the tumor, and the risk of nerve injury is minimized.

Schwannomas are slow-growing benign peripheral nerve sheath tumors and are the most common peripheral nerve tumors.[1] They can present as painful masses and paresthesia and, less frequently, as motor weakness in the extremity.[2] The tumor is frequently encapsulated, and the tumor capsule consists of 3 layers (a nerve tissue layer, a fibrous layer, and a transitional layer).[3]

The aim of surgical treatment of a symptomatic schwannoma is total to gross total excision of the tumor along with preservation of the affected nerve and its function, particularly in patients with conserved functionality of a major nerve trunk.[2,4] Techniques for endoscopic resection of schwannomas have been reported.[1,3] The purpose of this Technical Note is to describe the details of nerve-preserving endoscopically assisted resection of a schwannoma of the radial nerve of the arm. This is essentially an intracapsular resection of the tumor and is indicated for a symptomatic schwannoma. It is contraindicated in case of a neurofibroma, a malignant nerve sheath tumor, or a tumor that passes through the intermuscular septum (Table 1).

From North District Hospital, Sheung Shui, China.

The authors report no conflicts of interest in the authorship and publication of this article. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received February 25, 2020; accepted March 12, 2020.

Address correspondence to Tun Hing Lui, M.B.B.S.(HK), F.R.C.S.(Edin), F.H.K.A.M., F.H.K.C.O.S., Department of Orthopaedics and Traumatology, North District Hospital, 9 Po Kin Road, Sheung Shui, NT, Hong Kong SAR, China. E-mail: luithderek@yahoo.co.uk

2212-6287/20295

https://doi.org/10.1016/j.eats.2020.03.002

Technique

Preoperative Planning and Patient Positioning

Preoperative magnetic resonance imaging is useful for confirmation of the diagnosis and evaluation of the spatial relation between the tumor and nerve, as well as surrounding structures (Fig 1). The motor and sensory function of the nerve should be carefully assessed and documented.

The patient is placed in the supine position, and an ipsilateral arm tourniquet is used to provide a bloodless surgical field. Fluid inflow is driven by gravity; an arthro-pump is not used; and a 4.0-mm, 30° arthroscope (Dyonics; Smith & Nephew, Andover, MA) is used.

Portal Placement

The procedure is performed with the anterior and posterior portals on the anterior and posterior sides of the tumor, respectively (Fig 2). A 5-mm longitudinal skin incision is made at the posterior portal site, and a 2.5- to 3-cm incision (depending on the size of the tumor) is made at the anterior portal site.

Exposure of Schwannoma

The posterior portal is the viewing portal, and the anterior portal is the working portal. The muscles are bluntly dissected from the tumor and nerve by a

Table 1. Indications and Contraindications of Nerve-Preserving Endoscopically Assisted Resection of Schwannoma of Radial Nerve

Indications
Symptomatic schwannoma
Contraindications
Neurofibroma
Malignant nerve sheath tumor
Tumor passing through intermuscular septum

hemostat and dental swab. The muscle is retracted with a small retractor via the anterior portal (Fig 3).

Resection of Schwannoma With Preservation of Radial Nerve

The posterior portal is the viewing portal, and the anterior portal is the working portal. The nerve is incised with a No. 15 blade scalpel to expose the tumor. Care should be taken not to injure the nerve fascicles and blood vessels. The nerve is then bluntly dissected from the tumor with a dental swab and hemostat (Fig 4). The tumor and nerve can be rotated by the retractor to facilitate dissection of the deep part of the tumor. Finally, the tumor is freed from the nerve and is removed via the anterior portal (Fig 5). The integrity of the radial nerve is then checked endoscopically (Fig 6, Video 1, Table 2). The skin incisions are closed with simple sutures, and immediate free mobilization is allowed.

Fig 1. Nerve-preserving endoscopically assisted resection of schwannoma of radial nerve in right arm. The patient is in the supine position. Magnetic resonance imaging shows the location of the schwannoma (S). (RH, radial head.)

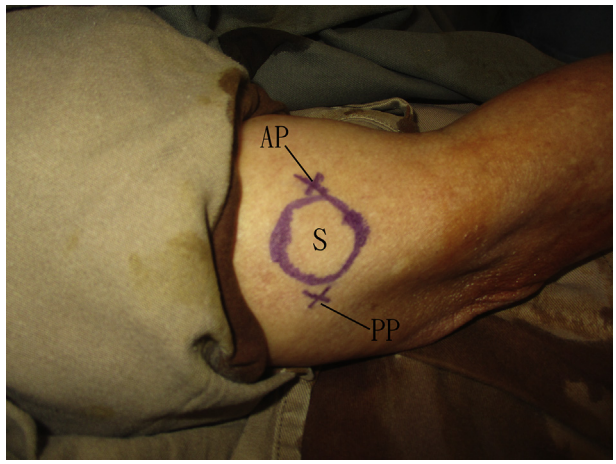

Fig 2. Nerve-preserving endoscopically assisted resection of schwannoma (S) of radial nerve in right arm. The patient is in the supine position. The procedure is performed with the anterior portal (AP) and posterior portal (PP) on the anterior and posterior sides of the tumor, respectively.

Discussion

Lesion enucleation is usually considered possible for schwannomas, and intracapsular resection of the tumors can minimize the risk of nerve injury during

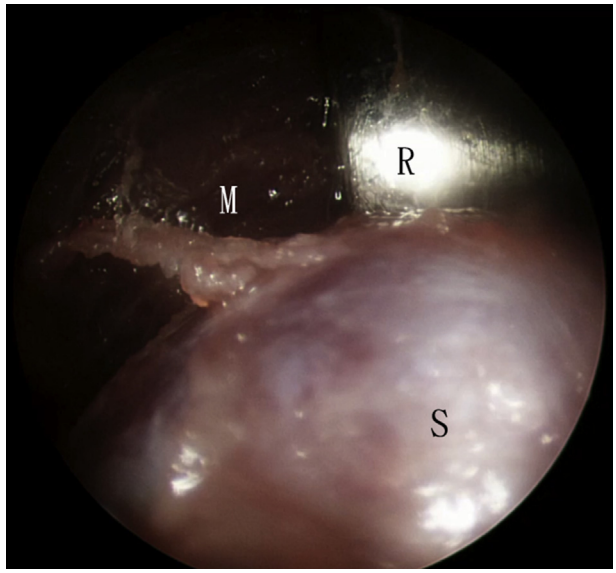

Fig 3. Nerve-preserving endoscopically assisted resection of schwannoma (S) of radial nerve in right arm. The patient is in the supine position. The posterior portal is the viewing portal, and the anterior portal is the working portal. The muscles are bluntly dissected from the tumor and nerve by a hemostat and dental swab. The muscle (M) is retracted with a small retractor (R) via the anterior portal.

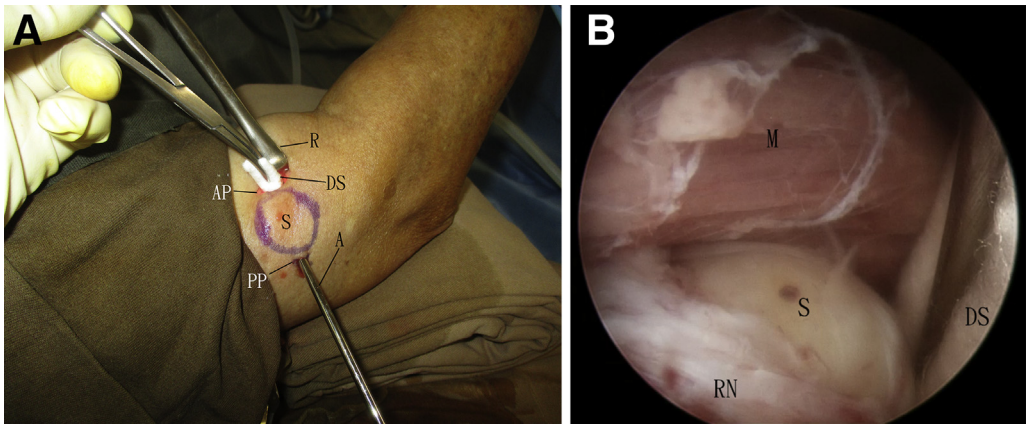

Fig 4. Nerve-preserving endoscopically assisted resection of schwannoma (S) of radial nerve (RN) in right arm. The patient is in the supine position. (A) The posterior portal (PP) is the viewing portal, and the anterior portal (AP) is the working portal. (B) The nerve is bluntly dissected from the tumor with a dental swab (DS). (A, arthroscope; M, muscle; R, retractor.)

tumor resection.[3,5] Classically, this has been performed under a microscope; however, there is a risk of a perioperative fascicle lesion even when using a microscope.[5] In comparison with the microscopic view, endoscopic visualization can achieve better differentiation between the tumor mass and its capsule.[3] However, before considering endoscopic surgery, thorough preoperative clinical and radiographic assessments must be conducted to ascertain the benign nature of the tumor.[1]

An arm tourniquet is used to keep a clear endoscopic field during tumor resection. The tourniquet limits the placement of the portal proximal to the tumor; therefore, we use portals anterior and posterior to the tumor rather than proximal and distal to the tumor. Moreover, the anterior and posterior

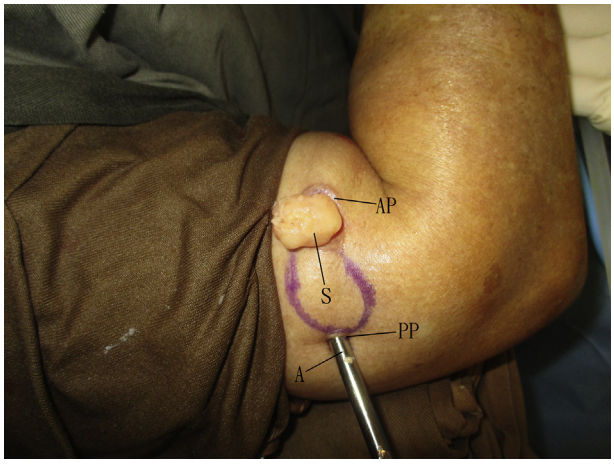

Fig 5. Nerve-preserving endoscopically assisted resection of schwannoma (S) of radial nerve in right arm. The patient is in the supine position. The tumor is freed from the nerve and is removed via the anterior portal (AP). (A, arthroscope; PP, posterior portal.)

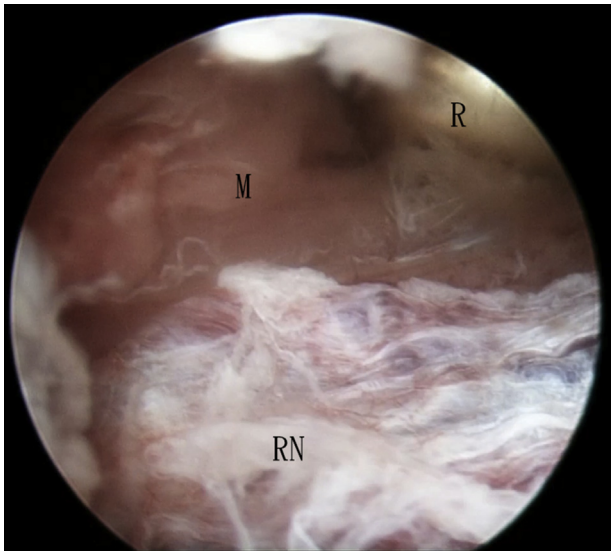

Fig 6. Nerve-preserving endoscopically assisted resection of schwannoma of radial nerve (RN) in right arm. The patient is in the supine position. The posterior portal is the viewing portal, and the anterior portal is the working portal. The integrity of the RN is checked endoscopically. (M, muscle; R, retractor.)

Table 2. Pearls and Pitfalls of Nerve-Preserving Endoscopically Assisted Resection of Schwannoma of Radial Nerve

Pearls
The portals should be close to each other to facilitate a bird's-eye view of the tumor.
The tumor and nerve can be rotated by the retractor to facilitate dissection of the deep part of the tumor.
Pitfalls
Preoperative assessment to exclude a neurofibroma or malignant tumor is essential.
The surgeon should prepare to convert to open surgery once the endoscopic view is not clear.

portals have better freedom of mobilization because the skin is more mobile in the transverse direction than in the longitudinal direction.

Table 3. Advantages and Risks of Nerve-Preserving Endoscopically Assisted Resection of Schwannoma of Radial Nerve

Advantages
Less soft-tissue trauma
Better cosmetic results
Fewer wound complications
Better visualization of intracapsular tumor dissection
Risks
Postoperative neurogenic pain
New motor deficit
Nerve injury
Incomplete tumor resection

Our minimally invasive technique has the advantage of less soft-tissue trauma, better cosmetic results, fewer wound complications, and better visualization of the intracapsular tumor dissection. The potential risks of this technique include postoperative neurogenic pain, new motor deficit, nerve injury, and incomplete tumor resection (Table 3). This technique is not technically demanding and can be attempted by the average arthroscopist.

References

1. Lafosse T, Hanneur ML, Popescu IA, Bihel T, Masmejean E, Lafosse L. All-endoscopic resection of an infraclavicular brachial plexus schwannoma: Surgical technique. *Arthrosc Tech* 2018;7:e869-e873.
2. Desai KI. The surgical management of symptomatic benign peripheral nerve sheath tumors of the neck and extremities: An experience of 442 cases. *Neurosurgery* 2017;81:568-580.
3. Ying GY, Yao Y, Shen F, Wu ZY, Chen CM, Zhu YJ. Percutaneous endoscopic removal of cervical foraminal schwannoma via interlaminar approach: A case report. *Oper Neurosurg (Hagerstown)* 2018;14:1-5.
4. Carvi y Nievas MN, Archavlis E, Unkel B. Delayed outcome from surgically treated patients with benign nerve associated tumors of the extremities larger than 5 cm. *Neurol Res* 2010;32:563-571.
5. Akambi Sanoussi K, Dubert T. Schwannomas of the peripheral nerve in the hand and the upper limb: Analysis of 14 cases. *Chir Main* 2006;25:131-135.