

Endoscopic En-Bloc Resection of Intra-Muscular Lipoma of the Flexor Digitorum Profundus: A Uniportal Technique



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Abstract: Deep-seated lipomas can be intramuscular, intermuscular, and rarely, parosteal lipomas. Intramuscular lipoma can be divided into infiltrative, well-circumscribed, and mixed types. Marginal excision is the treatment of choice for well-circumscribed intramuscular lipoma, and histopathology eliminates diagnosis of well-differentiated liposarcoma. The purpose of this technical note is to describe the details of endoscopic en-bloc resection of intramuscular lipoma of the flexor digitorum profundus. This minimally invasive approach allows en-bloc resection of the lipoma for histopathological study, with minimal risk to the surrounding neurovascular structures.

Introduction

Lipoma is benign soft tissue tumor that consists entirely of mature adipocytes and can occur superficially or deep to the deep fascia.^{1,2} Deep-seated lipomas can be intramuscular, intermuscular, and rarely, parosteal lipomas.² Intramuscular lipoma can be divided into infiltrative, well-circumscribed and mixed types.^{3,4} Infiltrating intramuscular lipoma comprises mature fat cells interdigitated with skeletal muscle and has an incomplete capsule.^{2,5}

Intramuscular lipoma of the forearm is rare and has been reported in the form of case reports or case series in the literature.^{3,5-12} It often manifests as an asymptomatic, slow-growing mass or swelling with no obvious mass.^{4,12} It can occasionally be painful, limiting

motion of the muscle if the tumor is large enough or causing symptoms of neurovascular compromise if it is located near a nerve or blood vessel.^{2,4}

Classically, lipoma is resected via open approach, which may result in a lengthy disfiguring surgical scar.^{13,14} Techniques of endoscopic lipoma resection have been proposed to improve the cosmetic result, while allowing the tumor to be resected under endoscopic visualization and adequate hemostasis.¹³⁻²¹ In most of these techniques, lipomas are resected in piecemeal, and the tumor is fragmented before it can be determined whether it is benign or malignant.^{13-15,18,21} Endoscopic en-bloc tumor resection has been advocated to obtain a whole block specimen for histological examination.^{13,14,17,22-27} The purpose of this technical note is to describe the details of endoscopic en-bloc resection of

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Table 1. Indications and Contraindications of Endoscopic En-Bloc Resection of Intramuscular Lipoma of the Flexor Digitorum Profundus: A Uniportal Technique

Indications	Contraindications
1. Symptomatic well-circumscribed lipoma of the flexor digitorum profundus, especially for growing tumor	1. Infiltrating intramuscular lipoma 2. Liposarcoma 3. The tumor extended outside the boundary of the muscle and impinging surrounding neurovascular bundle (relative contraindication). 4. The neurovascular bundle is encased.

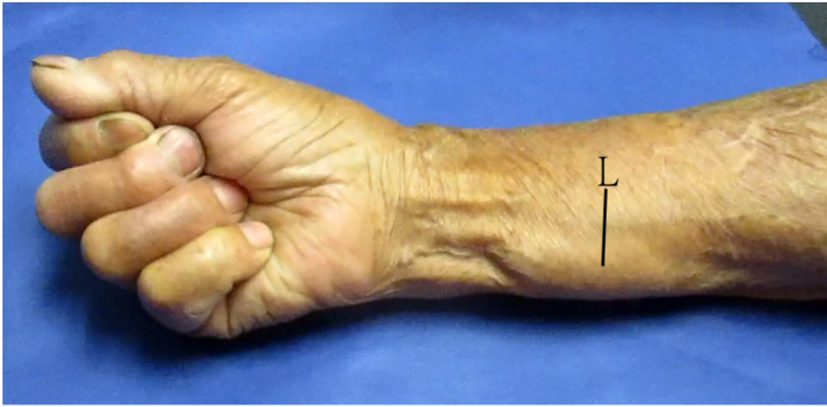


Fig 1. The patient is in the supine position with the forearm on the side table. Clinical photo shows that the lipoma becomes more prominent when the patient holds a fist. L, lipoma

intramuscular lipoma of the flexor digitorum profundus. It is indicated in case of symptomatic well-circumscribed lipoma of the flexor digitorum profundus, especially for a growing tumor. It is contraindicated in cases of infiltrating intramuscular lipoma or liposarcoma. It is relatively contraindicated if the tumor extends outside the boundary of the muscle and impinging surrounding neurovascular bundle. If the neurovascular bundle is encased, open dissection is needed (Table 1).

Surgical Technique

Preoperative Assessment and Patient Positioning

The mass moves with finger motions and becomes more prominent when the patient holds a fist (Fig 1). Preoperative magnetic resonance imaging (MRI) provides important information about the size, extent, and nature and homogeneity of the mass, and its anatomical relationship with the flexor digitorum profundus



Fig 2. The patient is in the supine position with the forearm on the side table. Magnetic resonance imaging shows the intramuscular lipoma. A shows the coronal view, B shows the transverse view, and C shows the sagittal view. L, lipoma; R, radius; U, ulna.



Fig 3. The patient is in the supine position with the forearm on the side table. This procedure is performed via the distal ulnar portal, which serves for both viewing and working. The portal is located at the junction between the flexor carpi ulnaris tendon and the lipoma. DUP, distal ulnar portal; FCU, flexor carpi ulnaris tendon; L, lipoma.

and the surrounding neurovascular bundles and flexor tendons (Fig 2). The MRI should be carefully studied to look for any evidence of liposarcoma e.g. the presence of nonadipose tissue components, thick septa with hyperintense T2-weighted signal, or contrast enhancement.^{1,3}

The patient is in the supine position with the forearm on the side table. An arm tourniquet is applied to provide a bloodless operative field. A 2.7-mm, 30° arthroscope (Henke Sass Wolf GmbH, Tuttlingen, Germany) is used for this procedure. This is dry endoscopy, and no fluid inflow is required.

Portal Placement

This procedure is performed via the distal ulnar portal, which serves for both viewing and working. The portal is located at the junction between the flexor carpi ulnaris tendon and the lipoma (Fig 3). A 3-cm skin incision is made at the portal site. The underlying muscle is bluntly dissected with a hemostat until the underlying lipoma is exposed.

Dissection of the Lipoma

The distal ulnar portal is used for both viewing and working. The portal incision is retracted with a small

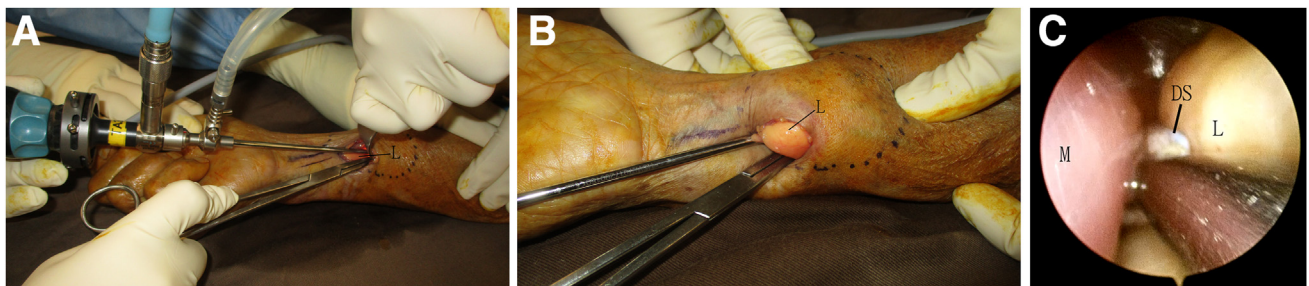


Fig 4. The patient is in the supine position with the forearm on the side table. The distal ulnar portal is used for both viewing and working. (A) The portal incision is retracted with a small retractor, and the lipoma is dissected from the surrounding muscle tissue with dental swab. (B) The assistant can push the mass toward the distal ulnar portal in order to stabilize the lipoma during dissection. (C) Endoscopic view shows the tumor is dissected out from the surrounding muscle tissue. DS, dental swab; L, lipoma; M, flexor digitorum profundus muscle.

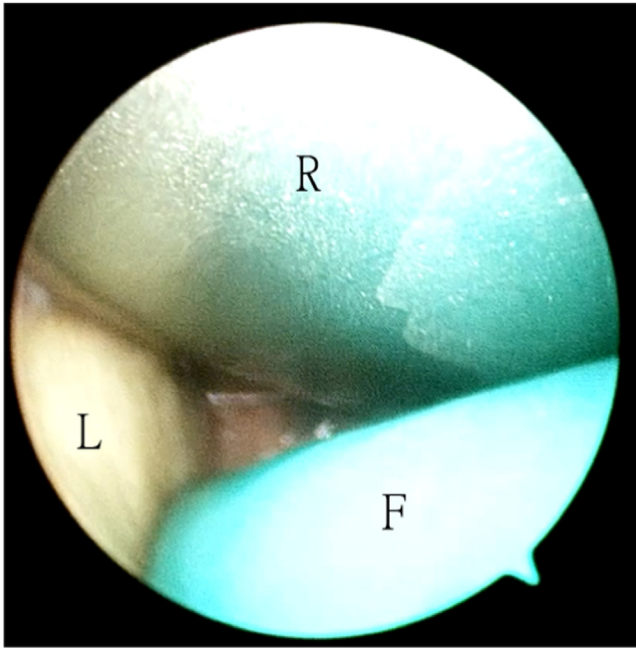


Fig 5. The patient is in the supine position with the forearm on the side table. Finger dissection under endoscopic visualization can provide additional tactile sensation of the lipoma and the surrounding tissue during the dissection and further the risk of injury to the adjacent neurovascular bundle. F, surgeon's gloved finger; L, lipoma; R, retractor.

retractor, and the lipoma is dissected from the surrounding muscle tissue with dental swab. The assistant can push the mass toward the distal ulnar portal in

order to stabilize the lipoma during dissection (Fig 4). Finger dissection under endoscopic visualization can provide additional tactile sensation of the lipoma and the surrounding tissue during the dissection and further the risk of injury to the adjacent neurovascular bundle (Fig 5).

Resection of the Lipoma

After the lipoma is completely freed from the surrounding tissue, the lipoma is rotated until the smallest dimension faces the portal incision. The portal incision is enlarged, and the lipoma is squeezed out (Fig 6, Table 2, and Video 1).

Discussion

Intramuscular lipoma is a lipoma that has invaded the muscular layer, sometimes with unclear boundaries.¹¹ It may recur if complete resection is not performed.¹¹ Magnetic resonance imaging should be performed before excision of intramuscular lipoma of the forearm, and a thorough preoperative plan should be established to reduce recurrence and preserve hand function.¹¹

Marginal excision is the treatment of choice for well-circumscribed intramuscular lipoma, and histopathology eliminates diagnosis of well-differentiated liposarcoma.^{4,12} In infiltrating masses, muscle fiber bundles pass through the tumor, and wide excision with a free margin in the infiltrative areas, whenever possible, will help prevent recurrences.^{3,4} Myectomy can be considered if sacrifice of the involved muscle is affordable.^{2,28} If complete resection is not possible or

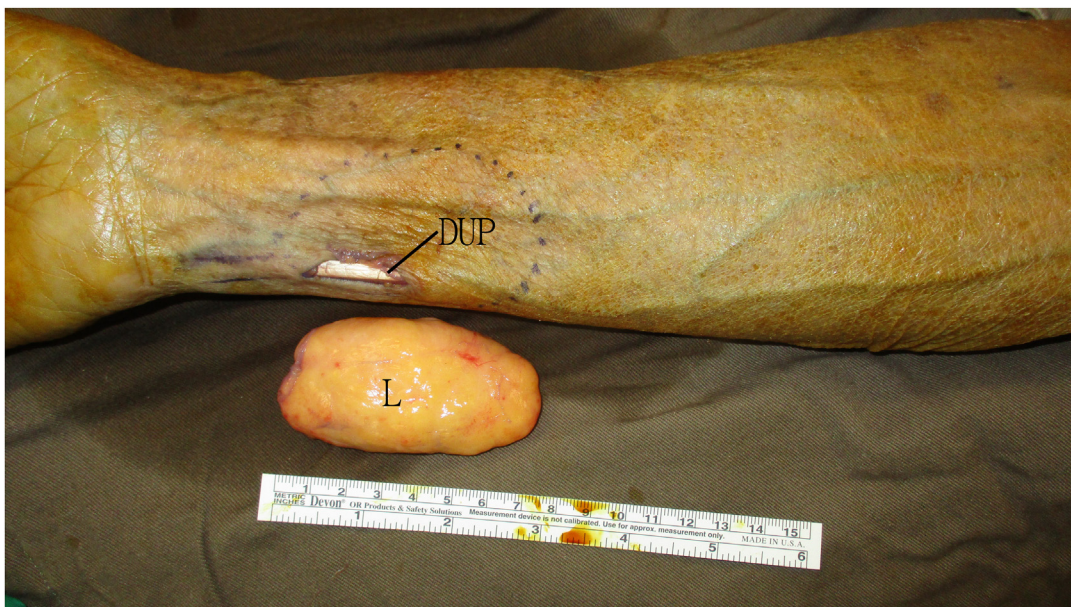


Fig 6. The patient is in the supine position with the forearm on the side table. The lipoma is resected en-bloc. DUP, distal ulnar portal; L, lipoma.

Table 2. Pearls and Pitfalls of Endoscopic En-Bloc Resection of Intramuscular Lipoma of the Flexor Digitorum Profundus: A Uniportal Technique

Pearls	Pitfalls
1. Dissection within the muscle belly can reduce the risk of injury to the adjacent neurovascular bundle.	1. Dissection beyond the boundary of the flexor digitorum profundus muscle may injure the adjacent neurovascular bundle.
2. Blunt dissection with dental swab can reduce the risk of injury to the adjacent neurovascular bundle.	
3. Finger dissection under endoscopic visualization can provide additional tactile sensation of the lipoma and the surrounding tissue during the dissection and further the risk of injury to the adjacent neurovascular bundle.	2. If there is component of infiltrating lipoma, marginal resection may lead to tumor recurrence.
4. After the lipoma is completely freed from the surrounding tissue, the lipoma is rotated until the smallest dimension faces the portal incision. This can minimize the length of the portal incision allowing removal of the lipoma.	

complete resection can lead to severe dysfunction, partial resection may be adequate.⁴

Because of the proximity to the neurovascular structures in the forearm, wide incision is usually considered to be necessary for excision of intramuscular lipoma of the forearm.³ Additionally, knowing the anatomical features of the compartment where the lipoma is localized in the forearm is important in planning surgery to enable easier dissection of the lipoma and lessen the risk of damage to adjacent neurovascular structures.³

In this reported technique, several measures are used to avoid injury to the surrounding neurovascular structure. Blunt dissection is used, and the dissection is within the boundary of the muscle. Moreover, finger dissection can provide additional tactile sensation to

further reduce the risk of injury to the surrounding neurovascular bundle. En-bloc excision of the lipoma can be achieved via this minimally invasive approach, and this can provide a whole piece of the tumor for histopathological examination.

The advantages of this technique include small incisions and better cosmetic outcome, minimal soft tissue trauma, and en-bloc resection of the lipoma. The potential risks of this technique include injury to the flexor tendons, the ulnar artery and nerve, median nerve or the anterior interosseous vessels and nerve, and incomplete tumor resection (Table 3). This procedure is not technically difficult and can be managed by average hand arthroscopists.

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Table 3. Advantages and Risks of Endoscopic En-Bloc Resection of Intra-Muscular Lipoma of the Flexor Digitorum Profundus: A Uniportal Technique

Advantages	Risks
1. Small incisions and better cosmetic outcome	1. Injury to the flexor tendons
2. Minimal soft tissue trauma	2. Injury to the ulnar artery and nerve
3. En-bloc resection of the lipoma	3. Injury to the median nerve
	4. Injury to the anterior interosseous vessels and nerve
	5. Incomplete tumor resection

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