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ORIGINAL ARTICLE

Outcomes of Surgical Decompression of Common Peroneal Nerve in Management of Foot Drop in Slimmer's Palsy

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ABSTRACT

Background: several methods of weight reduction appeared in the past few decades either surgical or non-surgical techniques, many of them resulting in unplanned rapid weight reduction with loss of fat cushion around common peroneal nerve (CPN) resulting in foot drop (Slimmer's palsy). The current study evaluated the clinical outcome after CPN decompression for Slimmer's palsy.

Methods: This study was conducted on seven patients (9 legs), (2 males & 5 females) with foot drop after rapid weight reduction attended to the Orthopedics and Traumatology department from 2021 to 2023. Seven patients with foot drop following rapid weight loss were confirmed by a nerve conduction study that revealed a decreased amplitude in proximal segments and a reduction in motor conduction velocity of the CPN around the fibular head in all cases, with no local causes on the knee X-ray. posterolateral surgical approach was used in all cases for CPN decompression

Results: Following surgical decompression ankle, toes dorsiflexion and foot eversion were improved together with improvement of nerve conduction in electrophysiological data.

Conclusions: Although it is rare, loss of the fat cushion around the nerve results in conduction deficit. Surgical decompression improves nerve conduction and correct foot drop.

Keywords: Surgical Decompression; Peroneal Nerve; Foot Drop; Slimmer's Palsy.

INTRODUCTION

The common peroneal nerve (CPN) is the major nerve supply to the leg. It arises as one of the two branches of the sciatic nerve. It enters the leg by crossing the fibular neck from the posterior to the anterior direction (1-3). CPN is liable for compression due to many factors, such as traumatic injuries to the fibular neck, prolonged recumbence, leg-crossing position, pressure of cast or brace edge, tumor, and metabolic disorder (4-5).

Although rare, Slimmer's Palsy has been a growing cause of CPN palsy in the past few decades. It was attributed to the loss of the fat cushion around the nerve in patients with rapid weight loss together with metabolic disorders from restricted diets in obese patients (6-9). The compression of CPN affects the motor power of the ankle, toes dorsiflexion and foot eversion (foot drop), gait changes, and sensory deficit over the dorsum of the foot (10). Conservative treatment with dietary supplements and vitamin B12 is the first line of treatment. If failed for more than a month, surgical decompression is then indicated (11).

Our hypothesis is that surgical decompression of common peroneal nerve can correct foot drop and improves the nerve conduction deficit following rapid weight loss in obese patients.

The aim of this study is to evaluate the clinical and electrophysiological results of surgical decompression of common peroneal nerve in patients with Slimmer`s palsy

METHODS

This study was conducted on seven patients (9 legs), (2 males & 5 females) with foot drop after rapid weight reduction attended to the Orthopedics and Traumatology department from 2021 to 2023. Every patient signed an informed consent and our institution`s IRB approved the study. There were two bilateral and five unilateral cases. The mean age of the patients was 31.8 (ranging from 22-40) years. The mean follow-up period was 25 months (range from 18-33 months). Eligibility criteria required patients who had Slimmer's palsy with negative knee imaging after 2 months of failed conservative treatment. There were two cases after diet restriction and 5 cases after bariatric surgery. The mean weight loss was 32.6 KG (range from 27-39 KG) in a mean period of 9.1 (range from 6-12) months. Patients with foot drop after fibular neck fracture or herniated lumbar disc prolapse were excluded. Electrophysiological study was done in all cases as it was the most valuable diagnostic tool in this study

Pre-operative evaluation

Clinical evaluation included evaluation of the ankle dorsiflexion (Figure 1), foot eversion, foot sensation and calf muscle circumference. Electrophysiological examination for all patients and radiological evaluation: X-ray (AP & lateral views in neutral) for knee and proximal tibia and MRI of the lumbosacral spine to roll out a herniated disc in clinical cases.

Surgical technique

With the patient in a supine position and under spinal anesthesia, a pneumatic tourniquet was applied to the thigh. The knee and the leg were dripped and draped.

The assistant positioned the limb and bent both the hip and knee 90 degrees. A curved skin incision was done centered over the fibular neck along the course of the common peroneal nerve. We then dissected through the subcutaneous tissues protecting the superficial subcutaneous nerves. The common peroneal nerve was located by rolling against the fibular neck,

We started with incising the posterior crural intermuscular band (Figure 2), the septum lying below the nerve (sandwiching the nerve) after that release the septum between the peroneus longus (PL) and extensor digitorum longus (EDL) the third facial septum between EDL and tibialis anterior muscle TA. Proximal decompression was then carried out with the protection of the sural nerve, at this point the whole nerve was freely mobile (Figures 3 and 4). To prevent hematoma formation, (which may be a secondary compression cause), release of tourniquet, control of any source of bleeding, and applying a suction drain, were done in all cases. Closure of wound in layers.

Postoperative care

Ankle foot orthosis was used for the first three weeks. Passive ankle motions were encouraged from the first day. Assisted weight bearing was allowed as tolerated by the patient; however, full weight bearing started in the second week. Clinical follow-up was done in the second week postoperatively and then monthly for 12 months. In all cases, a nerve conduction study was done at the fourth postoperative week.

Statistical analysis

Continuous variables were expressed as the mean ± SD & range, and categorical variables were expressed as a number (percentage). Continuous data were checked for normality by using Shapiro Walk test. Mann Whitney U test was used to compare two groups of non-normally distributed data. A p-value <0.05 was considered significant. All statistics were performed using SPSS 22.0 for windows (IBM Inc., Chicago, IL, USA).

RESULTS

Seven cases with foot drop were treated with surgical decompression of CPN after failure of conservative methods for one month. Age ranged from 22 to 40 years with a mean of 31.8. All cases of foot drop that occurred after rapid weight reduction ranged from 27 to 39 KG with a mean of 32.6 KG in a period ranging from 6 to 12 months with a mean of 9.1 months, after either diet restriction in 2 cases or surgical intervention in 5 cases. Motor manifestations appeared in all cases while sensory changes appeared in only 5 cases (Table 1).

Clinical results

a. Motor function: there was a statistically significant improvement in the final follow-up mean manual muscle test score (MMT) compared to the preoperative one. The mean MMT of the ankle dorsiflexors, toe extensors, and ankle evertors improved from 2.6, 2.6,

b. and 2.1 preoperatively to 4.4, 4, and 4.1 at the final follow-up respectively (Figure 5).

There was also a statistically significant improvement in calf muscle circumference from a mean of 31.05 Cm pre-operatively to 35.22 Cm at the final follow-up.

b. **Sensory function:** Five cases had sensory symptoms in the form of positive Tinel`s sign and skin paresthesia. Four of those cases were improved with only one case of persistent sensory symptoms.

c. Electrophysiological results: All cases showed decreased amplitude in proximal segments and a reduction in motor conduction velocity of the CPN around the fibular head. All were improved one month after the CPN decompression except in one case with persistent abnormalities in the motor conduction velocity (Figure 6).

Complications

There was a case of persistent foot drop that did not improve after surgical decompression. Tendon transfer (Bridle procedure: posterior tibial tendon was transferred to tibialis anterior and peroneus longus tendon) was performed in that case.

Table 1: Patient characteristics and pre& post-operative outcomes

NO			1	2	3	4	5	6	7
Age			25	33	37	22	40	27	39
Sex			male	female	female	female	female	male	female
Side			unilateral	bilateral	unilateral	unilateral	unilateral	bilateral	unilateral
Duration of weight loss till symptoms (months)			6	10	8	7	12	10	11
Weight reduction (in KG)			30	27	36	33	32	31	39
Weight reduction technique			Diet only	Diet only	operative	Gastric by bass	Gastric by bass	balloon	Gastric by bass
Motor function (manual muscle test MMT)	Foot dorsiflexion	pre	G 3	G 3	G 2	G 3	G 2	G 3	G 2
		post	5	5	5	4	5	4	3
	Toes dorsiflexion	pre	2	3	2	3	2	2	2
		post	4	5	5	4	4	4	2
	eversion	pre	2	2	2	3	2	2	2
		post	4	5	5	4	4	4	3
Sensory function	Dorsum of foot	pre	normal	affected	affected	normal	affected	affected	affected
		post	good	good	good	good	good	good	still
	leg	pre	normal	affected	affected	normal	affected	affected	affected
		post	good	good	good	good	good	good	still
Calf circumference		Pre (at onset of foot drop)	39	Rt:35 Lt:35	31	33	30	Rt:37 Lt:36.5	30
		Post (at final follow up)	40	Rt:36.5 LT:36	33	34	31	RT:38.5 LT:38	30
NCS	pre		slowing in motor conduction velocity demyelinating character	slowing in motor conduction velocity demyelinating character	slowing in motor conduction velocity demyelinating character	slowing in motor conduction velocity demyelinating character	slowing in motor conduction velocity demyelinating character	slowing in motor conduction velocity demyelinating character	slowing in motor conduction velocity demyelinating character
	post		Normal motor conduction velocity	Normal motor conduction velocity	Normal motor conduction velocity	Normal motor conduction velocity	Normal motor conduction velocity	Normal motor conduction velocity	Permanent Conduction deficit
Recovery timing			1 m	1.5 m	1 m	1.5 m	2 m	1.5 m	Permanent weakness
Follow up period (months)			24	33	18	28	25	24	23

Figure 1: Pre-operative data. Pre-operative weak ankle and toes dorsiflexion.

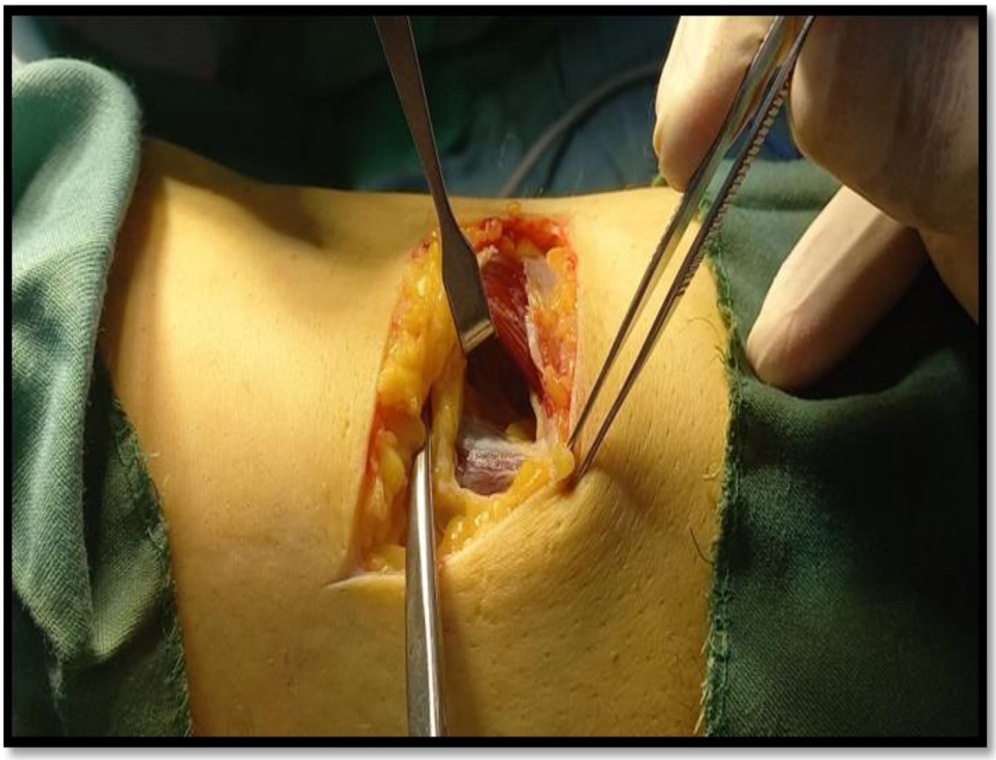


Figure 2: Incision of the fascia over the nerve then decompression of posterior crural intermuscular band is carried out (A) , then the septum lying below the nerve (sandwiching the nerve) (B)

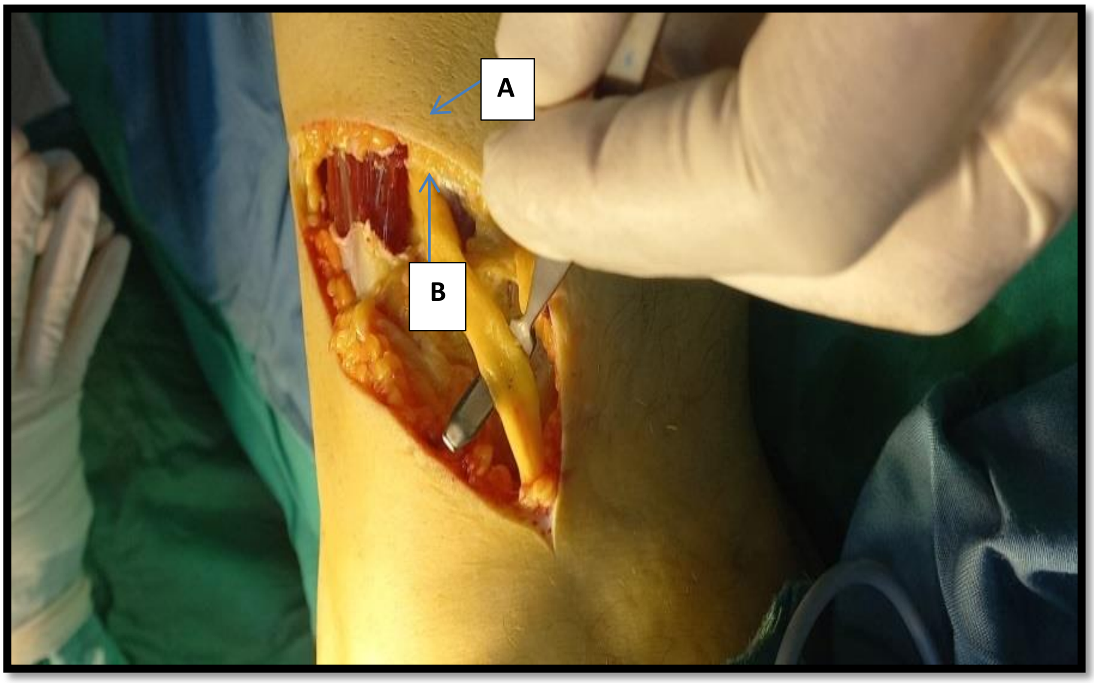


Figure 3: After complete distal release

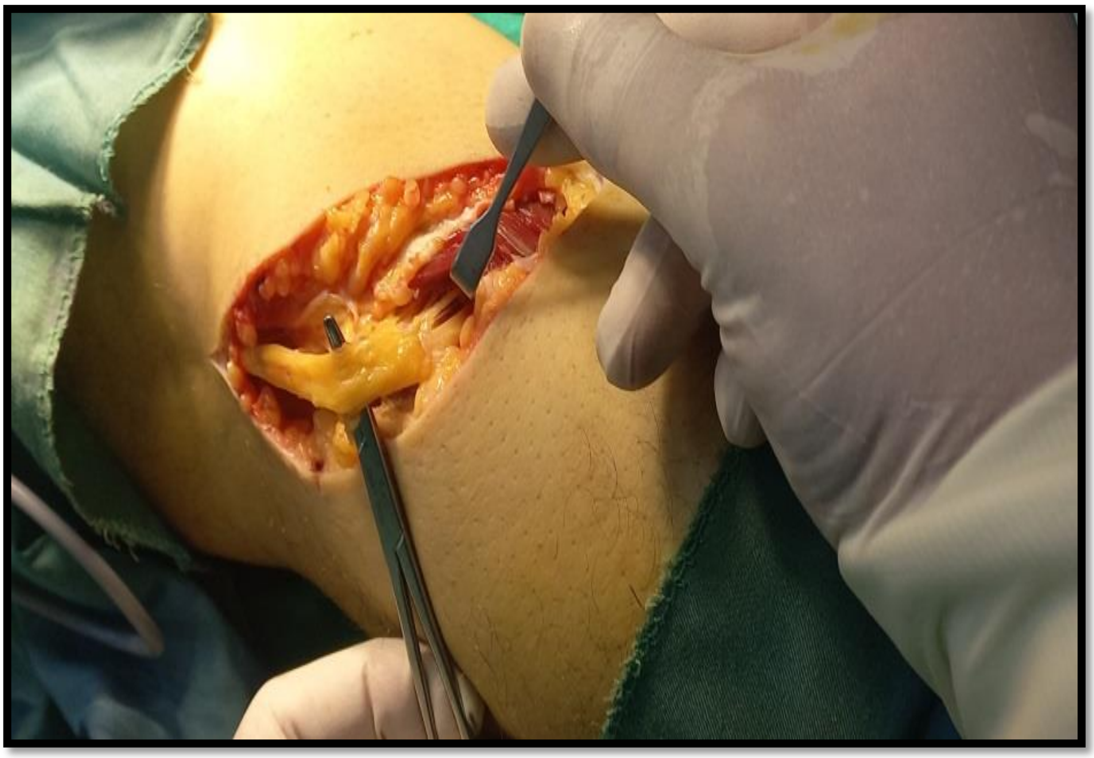
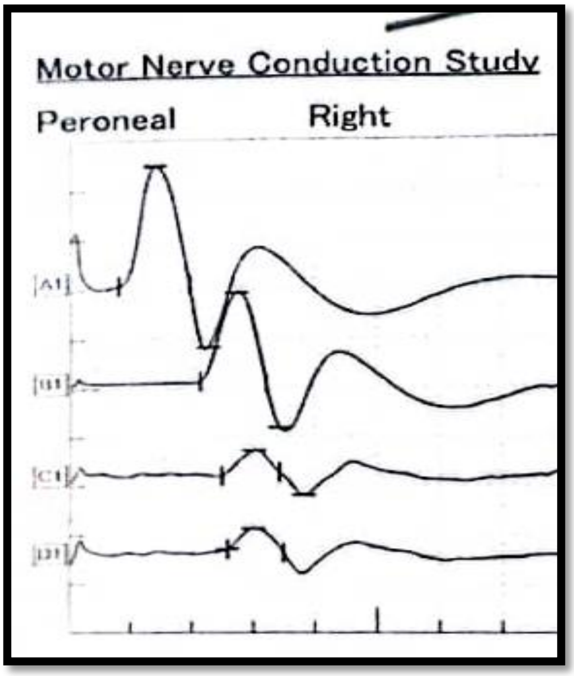


Figure 4: Proximal decompression is carried out

1.

2.

Figure 5: Post-operative data 1.Improvement of ankle and toes dorsiflexion 15 days after CPND. 2. Two months after CPND with normal ankle and toes dorsiflexion



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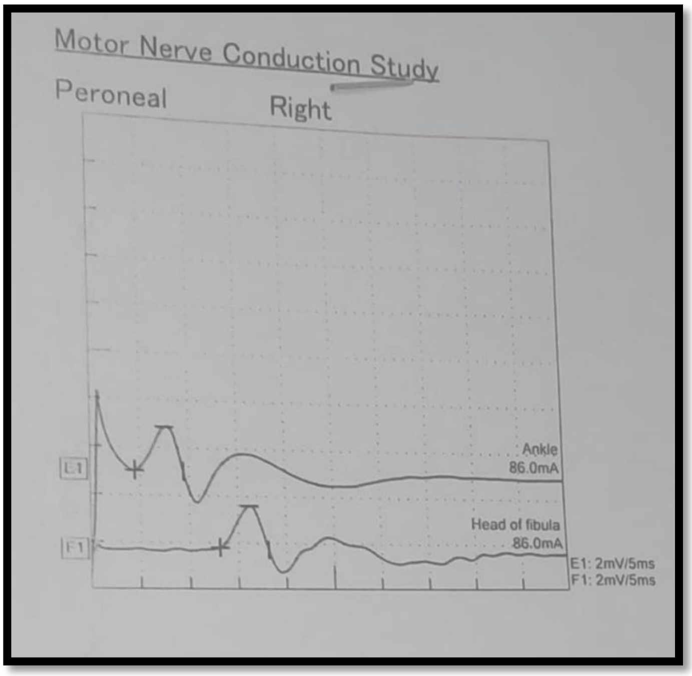

2.

Figure 6: Pre and post-operative nerve conduction. 1. Preoperative nerve conduction study showing reduction of compound muscle action potential (CMAP) amplitude around fibular neck : normal CMAP amplitude in thigh(A1) & proximal to head of fibula(B1), while reduced CMAP amplitude around fibular neck (C1) & behind knee joint (D1). 2. postoperative nerve

conduction study reveal normal CMAP amplitude around head of fibula

DISCUSSION

Common peroneal nerve entrapment is the most frequent nerve entrapment in the lower limb. CPN palsy can be caused by direct trauma to the fibular neck, soft tissue swelling, or a local mass. Also, unplanned rapid weight loss can cause CPN palsy and foot drop (12,9,13).

The era of rapid weight reduction has been misused in the past few decades, without adequate dietary supplements resulting in loss of the fatty cushion around the common peroneal nerve together with the metabolic disturbances associated with the dietary restriction causing the slimmer`s palsy (12, 5,14).

The primary clinical manifestation of Slimmer`s palsy is the weakness of the ankle dorsiflexion, toe extension, and foot eversion (figure 1) as well as sensory impairment in the distal leg and foot in some cases {details}. Nerve conduction studies show axonal degeneration and signs of denervation in muscles especially the tibialis anterior, extensor hallucis, and peroneus longus with the absence of local nerve compression causes by X-ray and MRI (15,16).

Once the diagnosis is confirmed, conservative treatment is started with adequate dietary supplements and vitamin B. The foot also is kept in ankle foot orthosis and strengthening physical exercises are started for the affected muscles (17).

Surgical decompression is indicated after the failure of conservative measures. Azami et al., recommend early surgical decompression as the first line of treatment in Slimmer`s palsy as they found good results with early surgical decompression compared to delayed surgery (18).

There is a rarity in the number of researches discussing the slimmer`s palsy. Moreover, the small number of cases in each research and the absence of control group for evaluation of the conservative treatment pose a challenge for putting a clear guidelines for management of the slimmer`s palsy (18).

In their series Azmi et al., reported slimmer`s palsy after bariatric surgeries with a weight loss from 68.9 to 100 KG in a period of 5 to 11 months for symptoms to appear, all cases with unilateral foot drop (18).

All cases were subject to conservative treatment in the form of a balanced dietary supplement with adequate intake of vitamin B12, folic acid, and pregabalin. Also, the foot is kept in a neutral position by ankle foot orthosis with strengthening physical exercises on the affected muscles for one month. Two cases were improved with these measures and were excluded from the current study. This is similar to that reported by Azmi and his colleagues, they reported two cases resolved after the conservative measures (gabapentin, AFO, and physiotherapy) (18).

Broekx and Weyns were advised for early CPN decompression and neurolysis. They emphasized that post-operative improvement in slimmer`s palsy depends on the duration of symptoms and the pre-operative muscle power (19).

We used the calf muscle circumference and manual muscle test score (MMT) for evaluation of the muscle power and it was improved from pre-operative 2.6 to 4.4 post-operative for ankle dorsiflexion, also MMT of toes dorsiflexors was improved from mean 2.6 (pre-operative) to 4 (post-operative) and MMT score of ankle eversion were improved from 2.1 to 4.1 post-operative (Figures 6 and 8). Calf muscle circumference also improved from a pre-operative mean of 31.05 to 35.22 post-operative mean. Also, sensory function (positive Tinel`s sign and skin paresthesia) was improved in four cases with persistent symptoms in one case.

In their series of patients with CPN compression after weight loss (mean of 27 KG weight loss), Stephen Miranda et al., reported that clinical improvement of manual muscle test in all five cases after surgical decompression of CPN (with the improvement of tibialis anterior MMT from a mean of 2.0 +.45 to 4.6+.24 postoperative, extensor halluces longus was improved from a mean of 2.0+.55 to 4.6+.24 postoperative, also MMT for peroneus longus was improved from a mean of 2.2+.58 to 4.6+.24 postoperative in post-operative follow up) (20).

Azmi Lale et al. reported that all cases with acute foot drop in their study had zero Medical Research Council scale for muscle strength pre-operative and were improved to 100 after surgical CPV decompression without any post-surgical complications (18).

In our series, we did NCS preoperatively, and all cases showed decreased amplitude in proximal segments and a reduction in motor conduction velocity around fibular the head. Six cases were improved after surgical decompression with only one case of unresolved changes.

According to Stephen Miranda et al in their series, the conduction threshold was reduced from 5.75 + 1.89 to 1.2 + 0.31 post-operative (20).

The mean time for post-operative improvement of symptoms in this study was 1.4 months with one case with no improvement after surgical decompression and was prepared for muscle transfer.

Limitations of the study include a small number of cases which may be attributed to the rarity of the disease and the absence of a control group to compare with. On the other hand our study gives a highlight spot on this rare condition in which the electrophysiological study was the main diagnostic tool that save a lot of time and money on unnecessary other investigations methods (X-ray or MRI)

CONCLUSION

Unplanned rapid weight reduction results in loss of fat cushion around the common peroneal nerve causing foot drop. Electrophysiological study is the best diagnostic tool for patients with Slimmer`s palsy. Early Surgical CPN decompression corrects nerve conduction deficit and improves muscle contraction power.

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