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CLINICAL ARTICLE

Decision making in the surgical treatment of meralgia paresthetica: neurolysis versus neurectomy

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Abstract
Background Surgical treatment options for meralgia paresthetica include neurolysis and neurectomy procedures. Reported success rates for pain relief are generally higher after neurectomy, but an obvious disadvantage compared with neurolysis is the loss of sensation in the anterolateral part of the thigh. In this study we analyzed our results on pain relief after both procedures, and we determined the impact of loss of sensation with a questionnaire.
Methods Between 1999 and 2009, all patients with persistent symptoms of meralgia paresthetica who presented to our clinic after failure of conservative treatment were offered a neurectomy procedure. After this period, the surgical strategy was changed to first neurolysis followed by neurectomy in case of failure. We retrospectively analyzed our results for both strategies with a questionnaire that was focused on pain relief, numbness and the impact of numbness.
Results Ten patients underwent a neurolysis with a 60 % pain relief rate compared to 87.5 % of the eight patients that primarily underwent a neurectomy. Most neurectomy patients (62.5 %) were not hindered by the numbness, 25 % sometimes and only one patient was frequently bothered, but was still satisfied with the outcome. The failures of neurolysis were secondarily treated by neurectomy, which resulted in pain relief in three out of four patients.
Conclusions This series confirms previous reports in the literature that have shown higher success rates for the neurectomy procedure. In addition, it shows that most patients are not bothered by the numbness following this procedure. These observations can be used in the surgical decision making for meralgia paresthetica.

Keywords Meralgia paresthetica · Neurolysis · Decompression · Neurectomy · Neurexeresis

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Introduction

Meralgia paresthetica (MP) is a tingling, stinging or burning sensation in the anterolateral part of the thigh often accompanied by varying degrees of numbness, caused by a mononeuropathy of the lateral femoral cutaneous nerve (LFCN). It is commonly idiopathic, but can also have a traumatic origin, such as seat belt and iatrogenic injury [12]. Especially iatrogenic injury, e.g., with the patient in the prone position during spinal surgery, allows determining the site of injury, close to the anterior superior iliac spine (ASIS), where the nerve bends at an angle of about 90 degrees to pass from the pelvis through the inguinal ligament to the thigh (Fig. 1). Usually symptoms are mild and resolve spontaneously. It may be severe and limit the patient's daily activities. Extension of the hip, for example, while walking or driving a car, may exacerbate symptoms. Temporary nerve block with a local anesthetic near the ASIS may relieve the symptoms and is often used to confirm the diagnosis [19]. MP is the most frequent mononeuropathy of the lower limbs and probably more common than recognized [5, 18]. It is often misdiagnosed, especially in children and adolescents [6]. The pure sensory symptoms in MP can be helpful in the differential diagnosis with lumbosacral radiculopathy and orthopedic conditions. Electrophysiology can support the diagnosis [13].

The initial treatment of MP is wait and see supported by conservative measures such as avoiding wearing tightly fitting

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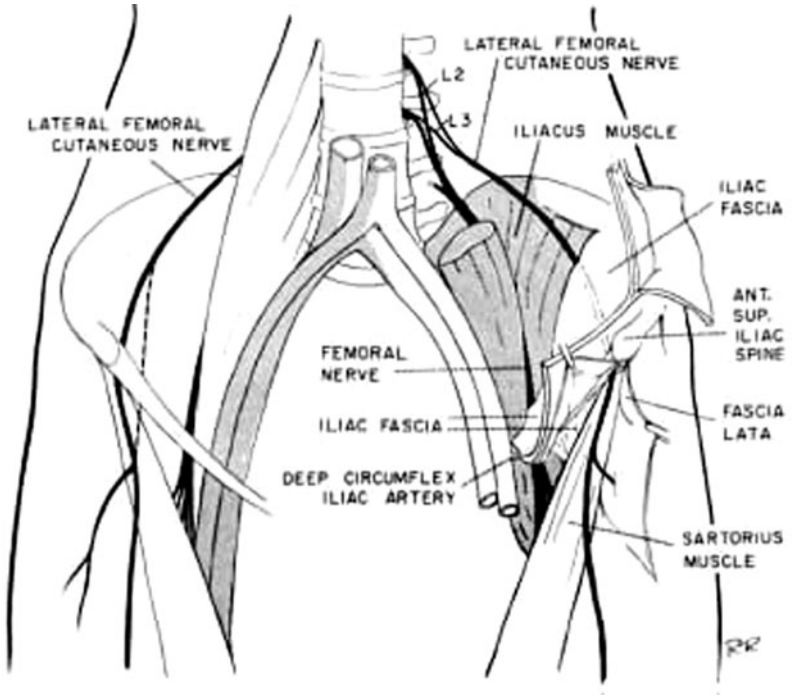

Fig. 1 Drawing of the course of the lateral femoral cutaneous nerve (LFCN) and its relation to muscles, fascias and the inguinal ligament. Obtained with permission from Keegan and Holyoke (1962) [8]

cloths, using analgetics and, for obese patients, losing weight. Pain relief is reported to be successful in about 90 % of the cases [19]. If conservative treatment fails, surgical treatment should be considered. The two main surgical options are neurolysis and neurectomy. In general, success rates are higher for the neurectomy procedure (Table 1), but an obvious disadvantage is loss of sensation in the anterolateral part of the thigh. The goal of our study was to compare the surgical results for both procedures on pain relief and to investigate the impact of numbness following the neurectomy procedure.

Methods and materials

Patient population

The medical records of all patients that were operated on at our clinic for persistent symptoms of idiopathic meralgia paresthetica between 1999 and 2010 were analyzed. Traumatic cases (including iatrogenic ones) were excluded. All patients had been referred by neurologists from different hospitals in and around The Hague (The Netherlands) after

Table 1 Literature review on surgical results for neurolysis and neurectomy (modified from Cochrane review [9]); presented in bold are the studies that have investigated both procedures

	First author, year of publication	Number of cases	Percentage pain relief		Remarks
			Complete (%)	Partial (%)	
Neurolysis	Teng 1972	84	82	14	Follow-up period not reported, but at least 17 months
	Macnicol 1990	25	60		Reported for complete and partial, all adult idiopathic cases
	Edelson 1994	21	67	24	Children and adolescents
	Nahabedian 1995	26	78	18	Traumatic cases (90 %)
	van Eerten 1995	10	30	30	Adult
	Antoniadis 1995	18	44	28	Adult
	Siu 2005	45	73	20	At long-term follow-up (mean 4 years), at 6 weeks 43 % complete, 40 partial
	Ducic 2006	48	55	24	19 cases with additional ilioinguinal, liohypogastric or genitofemoral nerve resection
Neurectomy	Williams 1991	24	96		Idiopathic and iatrogenic cases
	van Eerten 1995	11	82	18	Adult
	Antoniadis 1995	11	55	27	Adult

failed conservative treatment. In all patients pain relief on injection of 10 cc of local anesthetic confirmed the diagnosis of MP. In some patients (three), neurophysiological examination showed dysfunction of the LFCN. In patients in whom a radicular syndrome was suspected, a MRI scan of the lumbar spine was made to rule out spinal stenosis or nerve root compression. There was no history of pelvic/hip surgery.

Before December 2008, neurectomy was the first choice treatment. At the beginning of 2009, a shift in surgical strategy was made. Primarily, neurolysis was performed, and in case of failure, a secondary neurectomy procedure. All patients were seen at the outpatient clinic 2–4 weeks after the surgery. Results were categorized as complete, partial or no relief of symptoms. In case of partial or no relief, patients were seen again 2–3 months after the surgery. When still dissatisfied with the outcome, the patient was scheduled for a neurectomy procedure. For the purpose of this study, in addition, a questionnaire was sent out to all patients in January 2011 (after informed consent to participate in our study had been given by the patient by telephone). The questionnaire focused on pain relief, numbness and impact of numbness (see appendix). Patients who had been operated on both sites received two separate forms labeled with 'left' and 'right' leg. A return prestamped envelope was included.

Surgical procedures

With the patient under general anesthesia, a 4–6 cm incision was made (similar for both the neurolysis and neurectomy procedure) parallel to the inguinal ligament just inferior and medial to the anterior superior iliac spine. Under loupe magnification, the nerve was carefully identified in the fat tissue medial to the sartorius muscle (Fig. 2a). Subsequently, the nerve was followed back to the exit from the pelvis, where it passes through or just beneath the inguinal ligament. In the case of neurolysis, the inguinal ligament was partially cut (Fig. 2b) so a good dorsal and ventral decompression could be achieved. Special attention was paid to additional dorsal compression by a tendinous band of the iliac fascia, which was subsequently incised (Fig. 2c).

In the case of neurectomy the nerve was cut, the proximal end was clamped and the nerve was pulled out from the pelvis, often resulting in a total of about 5 cm of nerve with fascicles broken at different levels. In case of revision surgery after neurolysis, first potential compression at sites was ruled out before a neurectomy was performed.

Results

Clinical data

Between January 1999 and September 2010, a total of 22 procedures were performed. The duration of symptoms before the first surgery was 2.2 years (±1.3), (range 2.6 years in the neurolysis group and 1.7 in the neurectomy group). Mean age at the time of surgery was 51 years (±11). The female-to-male ratio was 1:2 (1:4 in the neurolysis group and 1:1 in the neurectomy group). Until December 2008, seven patients primary underwent a neurectomy procedure. After that neurolysis was the primary procedure and was performed in a total of ten patients. In one patient, neurolysis was planned in June 2009. During surgery, the procedure was switched to a neurectomy because no compression was found at the usual compression sites (instead the nerve was compressed by bulky sartorius and iliac muscles). In the neurolysis group, four patients reported having insufficient pain relief and therefore secondarily a neurectomy procedure was performed at a mean interval of 152 days after the first surgery. At revision surgery, no cases of incomplete decompressed LFCN were found. A total of 22 procedures were thus performed (10 neurolyses and 12 neurectomies) in 16 patients (2 cases of bilateral meralgia). There were no complications, except one postoperative hematoma in a neurolysis patient that was treated conservatively. There were no cases of deafferentiation pain after the neurectomy procedure. All operations were performed by the authors. Due to the shift in surgical strategy (around 2009), the mean follow-up was substantially longer for the neurectomy patients (mean 93 months) than for the neurolysis patients (mean 16 months).

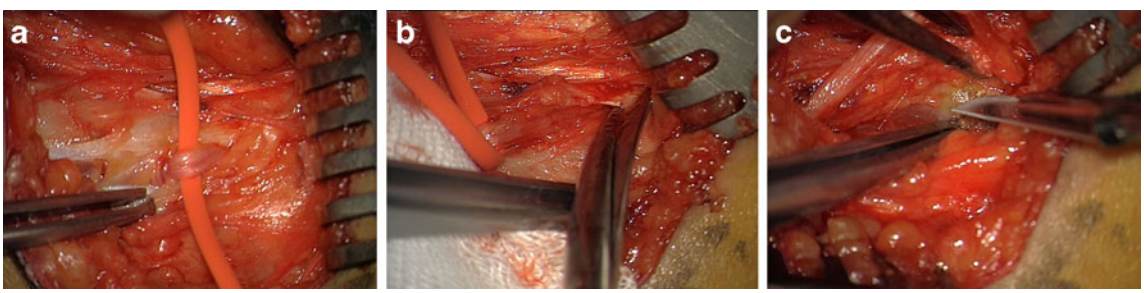

Fig. 2 Intraoperative images: (**a**) identification of the LFCN in fat tissue medial to the sartorius muscle, (**b**) partial cutting of the inguinal ligament over the LFCN, and (**c**) incision of the tendinous band of the iliac fascia after mobilization of the LCFN (that is lifted upward with the vessel loop)

Questionnaire

All patients returned their filled in questionnaire form within 2–4 weeks after informed consent had been obtained by telephone (100 % questionnaire response rate). Results showed that 60 % of the primary neurolysis patients had complete pain relief, and all of these patients were satisfied with the outcome (Table 2). After primary neurectomy, the pain had completely resolved in 75 % of the cases and was improved in one patient (12.5 %) (Table 3). In one patient the pain had worsened, and this patient was the only one dissatisfied with the outcome. For the question if they were bothered by the numbness, most primary neurectomy patients checked the box 'no' (5 out of 8 patients, 62.5 %), two patients checked the box 'sometimes' (25 %) and only 1 patient the box 'frequently' (12.5 %). This patient had the shortest follow-up (18 months) and still noted being satisfied with the outcome. After the secondary neurectomy, relatively more patients were bothered by the numbness: one 'sometimes,' one 'frequently' and one 'continuously' (Table 4).

Discussion

This study confirms results in the literature that generally have shown higher success rates for the neurectomy than for the neurolysis procedure (Table 1). Interestingly, our results on pain relief for both procedures are similar to the ones reported by van Eerten et al. [17]. In their study, however, reasons for performing either a neurolysis or a neurectomy procedure were not provided, whereas our study was based on two historical cohorts. In addition, our study also contains information on the impact of numbness after the neurectomy procedure, which may help the surgeon with determining the treatment strategy for meralgia paresthetica. Below, our results are compared to those published in the literature, and the pathogenesis of MP, variations of the neurolysis and neurectomy procedures, and the impact of numbness after neurectomy are discussed.

Comparison of the success rate for neurolysis to the ones published in the literature

Some studies have reported higher success rates for neurolysis than reported in our study [4, 6, 12, 14, 16]. The higher success rates in these studies might be explained by difference in patient categories, including children/adolescents [6] and traumatic cases [4, 12], and differences in the follow-up periods [14, 16]. In general, results for nerve recovery are better in children than in adults. After traumatic injury, nerve recovery is better

Table 2 Answers to the questionnaire after the primary neurolysis procedure

Patient no.	Pain				Numbness				Bothered by the numbness				Satisfied with the outcome		
	Completely resolved	Improved	Not changed	Worsened	Completely resolved	Improved	Not changed	Worsened	No	Sometimes	Frequently	Continuously	Yes	No	Partial
1	x					x			x				x		
2	x					x			x				x		
3															
4	x				x				na				x		
5															
6	x				x				na				x		
7															
8															
9	x					x			x				x		
10	x					x			x				x		

Patients 3, 5, 7 and 8 (failures of neurolysis) secondarily received a neurectomy procedure and are listed in Table 4 as patients 1, 2, 3 and 4
na = non-applicable

Table 3 Answers to the questionnaire after the primary neurectomy procedure

Patient no.	Pain				Numbness						Bothered by the numbness				Satisfied with the outcome		
	Completely resolved	Improved	Not changed	Worsened	Completely resolved	Improved	Not changed	Worsened	Since the surgery	At first, but improved	No	Sometimes	Frequently	Continuously	Yes	No	Partial
1	x								x		x				x		
2				x				x				x				x	
3		x				x						x			x		
4	x						x				x				x		
5	x								x		x				x		
6	x					x					x				x		
7	x					x					x				x		
8	x								x				x		x		

Table 4 Answers to the questionnaire after the secondary neurectomy procedure

Patient no.	Pain				Numbness						Bothered by the numbness				Satisfied with the outcome		
	Completely resolved	Improved	Not changed	Worsened	Completely resolved	Improved	Not changed	Worsened	Since the surgery	At first, but improved	No	Sometimes	Frequently	Continuously	Yes	No	Partial
1		x								x		x					x
2		x							x				x				x
3				x						x				x		x	
4	X								x		x				x		

than for the release of chronically compressed nerves. With regard to the longer follow-up in the study by Siu et al. [14], success rates for pain relief after decompression may increase with time, as was found in their study with 73 % complete pain relief and 20 % partial relief at long-term follow-up (mean 4 years) compared to 43 % complete pain relief and 40 % partial at 6 weeks. In our study, only adult idiopathic cases of MP were included. A longer follow-up for the four failures of neurolysis was not considered to be a good option because these patients experienced so much discomfort that they insisted on undergoing a neurectomy procedure.

Another explanation for the relatively low success rate for neurolysis in our study, however, may be a too long duration of symptoms before surgery (mean 2.2 years and 2.6 years in the neurolysis group). It might be (as stated by Dr. Kline in an invited comment on the article by van Eerten et al. [17]) that in some cases so many intraneural changes had occurred that neurolysis was not sufficient and resection of the 'pain generator' was needed. This theory of 'irreversible intraneural changes' is also supported by results from other studies. Macnicol et al. [11], for example, reported that neurolysis was unsatisfactory if symptoms had been present for longer than 18 months in their series. In addition, re-exploration and more extensive decompression of the nerve in the failures in that study (10 out of 25 neurolysis cases) resulted only in temporary relief in two cases, and eight cases had no benefit. Ivins [5] in 2000 published a small series. He concluded that in adult patients with symptoms longer than 1 year, resection should be the first choice, because all his cases of neurolysis after 1 year of complaints had failed. Finally, in the study by Antoniadis et al. [3], 8 out of 11 patients (73 %) with duration of symptoms less than a year were free of pain after neurolysis, compared with 7 out of 15 patients (47 %) who had symptoms for longer than a year. Explanations for these observations that results of neurolysis are inferior after chronic compression of the LFCN may be found in the pathogenesis of idiopathic MP.

Pathogenesis of idiopathic MP

In the literature, MP is often reported in relation to obesity and the wearing of tight cloths. However, other factors may also play a role, including repetitive exercise. In 1928 Stookey in his article on MP [15] already noted being impressed by the accentuation of the symptoms by standing or walking, with relief when sitting or lying down. He suggested that MP develops because of repetitive stretching of the LFCN over the sharp edge of the ilium. He compared this angulation of the LFCN to the position of the ulnar nerve at the elbow, where neuritis develops after repeated stretching of the nerve at the elbow joint. MP may develop accordingly because of repetitive movements in the hip joint. Another or additional explanation may be ischemic changes to the LFCN due to compression in the inguinal canal. In obese or pregnant patients, the LFCN may be compressed by the downward pull of the inguinal ligament because of the attachment of the fascia of Scarpa to the fascia lata just below the inguinal ligament [8]. In athletes, the LFCN may be compressed by hypertrophic iliac and sartorius muscles [10], as was found in one of our cases. In that case, the planned neurolysis was switched during surgery to a neurectomy procedure. Finally, anatomical variations in the course of the LFCN may lead to MP. In rare cases, the nerve may cross over the iliac crest and be compressed by wearing tight belts [7].

Variations of the neurolysis and neurectomy procedures

To rule out a more proximal compression of the inguinal ligament of the LFCN, a suprainguinal surgical approach can be used [1, 2]. Alberti et al., for example, have used this technique, but found a similar satisfaction rate for neurolysis (66 %) as reported in our study (1). Sometimes intrapelvic inspection with a scope is proposed. In older articles, transposition of the LFCN has also been described [2, 8], in analogy to the treatment of ulnaropathy. The angle of the course of the nerve, however, cannot be reduced as much as in transposition of the ulnar nerve, which may be the reason that this technique has been (largely) abandoned.

In the neurectomy procedure, some authors pull the nerve distally and cut it as proximal as possible so the released end falls back into the pelvis [3, 19]. We prefer to first transect the nerve and then pull the nerve out of the pelvis so the individual fascicles break at different levels, possibly reducing the chance of developing a painful neuroma compared with the afore-mentioned neurectomy procedure, although this lacks scientific evidence. No cases of painful neuroma or deafferentiation pain were noted in our series of neurectomy patients, nor in the studies by Williams [19], Antoniadis [3] and van Eerten [17].

The impact of numbness following the neurectomy procedure

In addition to a higher success rate for the neurectomy procedure, our study shows that most patients were not bothered by the numbness (62.5 %) following the section of the nerve, and some (25 %) only sometimes. It is important to realize that the follow-up period for the neurectomy group in our study was relatively long (mean 93 months). In time, sensory axons from

neighboring areas may sproute and reinnervate the anesthetic area, which may explain the fact that three patients noted that the area of numbness had improved since the surgery. The only patient that noted being frequently bothered by the numbness had the shortest follow-up (18 months). In the secondary neurectomy group, more patients were hindered by the numbness. The follow-up period in this group was much shorter (mean 5 months). In the neurectomy series of Antoniadis, 7 out of 11 patients continued to have the same numbness several years after the procedure; only 3 patients reported improvement after the procedure, and 1 experienced more numbness [3].

Also after neurolysis patients may experience numbness. In the study by Macnicol [11], 7 out of 11 patients with complete relief of symptoms after neurolysis had persistent mild sensory loss to light touch. In our study, in successful cases of neurolysis the numbness had completely resolved in two patients and was improved in the other four.

Despite the fact that numbness did not bother most patients in our study, it should be discussed with every patient preoperatively. Local injection with lidocaine, which should also be performed to diagnose MP, may be helpful in allowing the patient to experience the anticipated results of a nerve resection.

Conclusion

Results of our study show that chances for pain relief in adult patients with meralgia paresthetica are higher after the neurectomy than after the neurolysis procedure, and that most patients are not bothered by the numbness following the neurectomy procedure. Although our study has several shortcomings, including (1) that is retrospective, (2) concerns a small series of patients on which no statistical analysis could be performed, (3) that the follow-up was relatively long for the neurectomy patients and (4) that the neurectomy was performed relatively early after neurolysis, the presented observations can be used in decision making for the surgical strategy in MP. More research is needed to answer questions on the pathogenesis of MP. A randomized, multicenter trial will soon be started, coordinated from our center, to compare the results for the neurolysis versus the neurectomy procedures.

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Conflicts of interest None.

Appendix

English translation of the follow-up questionnaire (adapted from [1]):

Compared with the time before surgery the painful sensation over the thigh is

- ☐ completely resolved
- ☐ improved
- ☐ not changed
- ☐ worsened

Compared with the time before surgery the numbness over the thigh is

- ☐ completely resolved
- ☐ improved
- ☐ not changed
- ☐ worsened
- ☐ numbness since the surgery
- ☐ numbness since the surgery, but gradually improved

In case of numbness, how much does the border you

- ☐ not at all
- ☐ sometimes
- ☐ often
- ☐ continuously

I am satisfied with the outcome

- ☐ yes
- ☐ no
- ☐ partially

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