Morbidity following a modified sural nerve harvesting procedure in pediatric patients

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1 Introduction

Nerve grafts are used for the reconstruction of peripheral nerve defects (both congenital and traumatic) when primary coaptation of the damaged ends cannot be achieved due to insufficient length[1–2]. The sural nerve is commonly used for this purpose because it is a purely sensory nerve innervating the lateral foot. Therefore, its harvest is thought to result in minimal morbidity, justifying its use for the reconstruction of more impactful motor and sensory deficits[3–4].

While sural nerve harvest is common for reconstruction of peripheral nerve injuries, there is a tremendous paucity of literature in both adult and pediatric populations. Only one study describes sensory deficits following this procedure in children[5]. All patients in this study underwent bilateral sural harvest in the neonatal period for the reconstruction of obstetrical brachial plexus palsy. Therefore, this study may not accurately describe the sensory deficits expected following unilateral harvest in older children. Therefore, it's important to investigate outcomes in older children with unilateral sural nerve harvest in order to better inform patients of the expected outcome.

2 Objectives

To provide the first analysis of sensory outcomes following sural nerve harvest in older children using a modified technique of unilateral sural nerve harvest.

3 Methods

A cross-sectional study was conducted on pediatric patients older than six years of age who had undergone unilateral sural nerve harvest. Patients were recruited during routine clinic visits at a minimum follow-up of six months. Patients with any cognitive or developmental delay were excluded. Sensory threshold testing was conducted on four standardized locations in the sural nerve distribution of both feet using Semmes Weinstein Monofilaments. Results were compared to the unoperated contralateral foot using Fisher's exact test. Patients also completed a sensory function and pain questionnaire.

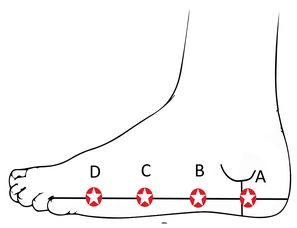


Figure 1. Semmes-Weinstein Monofilament testing. Points are marked along a line drawn horizontally at the midpoint between the lateral malleolus and the sole

Functional Sensory and Pain Questionnaire

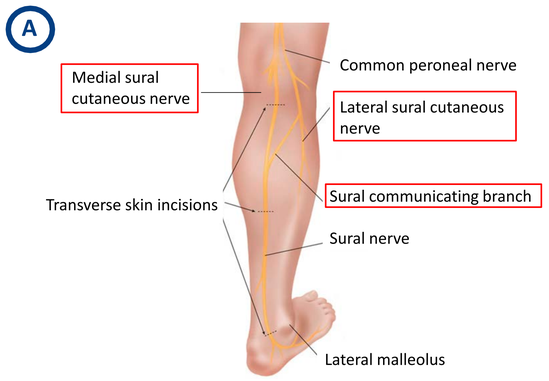
In the past week...

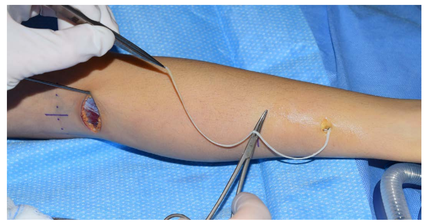
	None of the time	A little of the time	Some of the time	Most of the time	All of the time
1. My feet feel the same	1	2	3	4	5
2. My foot felt numb (i.e. no feeling)	1	2	3	4	5
3. I had pain in my foot	1	2	3	4	5
4. I had pain in my foot when touched	1	2	3	4	5
5. The skin on my foot didn't like the feeling of cold objects or the cold weather	1	2	3	4	5
6. I had concerns about the feeling in my foot	1	2	3	4	5
7. The skin on my foot looked different than in other kids	1	2	3	4	5
8. I had difficulty walking	1	2	3	4	5
9. I had difficulty with running or jumping	1	2	3	4	5

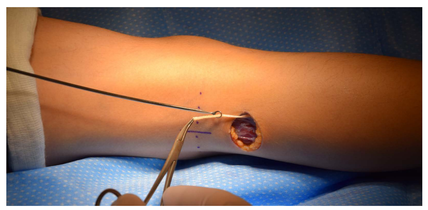
Figure 2. Sample of the functional sensory and pain questionnaire. The questionnaire encompasses three main domains: sensory (pain, cold), ambulation, and appearance.

4 Surgical Technique

The sural nerve is known to arise from both medial and lateral sural cutaneous components, which then become confluent as the sural nerve travels down the posterior leg (A). Dissection begins in the popliteal fossa and the tibial contribution to the sural nerve is isolated (B). Delivery of the graft material is made with a counter incision in the lower calf (C). This is in contrast to traditional techniques in which the dissection begins distally and proceeds proximally, harvesting the entire sural nerve.







5 Results

Fourteen patients were included in the study. Mean age at operation was 10.7±4.2 years with a mean follow up time of 1.84±1.43 years. Sensory thresholds were restricted to the two most sensitive Semmes Weinstein monofilaments in the control group, indicating no sensory deficit. In contrast, after sural nerve harvest, 25% of all locations tested demonstrated abnormal sensation. Significant sensory deficits were found at all four locations in the sural nerve distribution ($p<0.05$). The questionnaire revealed that only two patients expressed concerns about foot functionality, both in relation to physical activity, and no patients reported pain in their feet.

Table 1: Patient Demographics

	OUR STUDY (MEAN; SD)	LAPID ET. AL
N	14	14
BILATERAL/UNILATERAL	Unilateral	Bilateral
AGE AT SURGERY (YRS)	10.7 (4.2)	<1
TIME TO ASSESSMENT (YRS)	1.84 (1.43)	>5
AGE AT ASSESSMENT (YRS)	13.7 (3.9)	8

Table 2: Sensory Testing

SEMMES- WEINSTEIN FILAMENT NUMBER	PATIENT TARGETS (%)	CONTROL TARGETS (%)
0.5	28	96
2.0	48	4
10.0	9	
50.0	13	
200.0	2	
NO SENSATION		
TOTAL	100.0	100.0

Note: SW score >2.0 is abnormal

Table 3: Sensory Distribution by Site

	Normal		Abnormal			
	0.5	**2.0**	**10.0**	**50.0**	**200.0**	**P-VALUE**
A	5	3	2	4	-	0.0006
B	1	9	2	2	-	<0.0001
C	3	10	-	1	-	0.0003
D	7	5	1	-	1	0.039

Sensory Questionnaire

-"I had pain in my foot": **no patients**
-"Both my feet feel the same": **13 patients**

-"I had difficulty walking": **1 patient**
-"I cannot do the same things as other kids my age because of the movement in my foot": **1 patient**

6 Future Work

This study is limited largely by its cross-sectional nature and by its small sample size. Therefore, larger prospective studies in the future will help to validate these findings. Future comparison studies against traditional techniques may also prove useful to microvascular surgeons.

Significance

This study can be used as a valuable resource to inform patients and their families of the expected outcomes of these procedures. Comparison of our technique to previous pediatric studies is not possible due to the younger age of harvest and the inability of patients to perceive a deficit due to bilateral harvest in those studies. Therefore, this study does not simply add to the pediatric literature, but rather defines the deficit that can be expected following a modified technique of unilateral sural nerve harvest in an older pediatric population. Formal comparison of our technique to more traditional techniques of sural nerve harvest would require age-matched controls, owing to the much younger age of patients in previous pediatric studies.

References

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