LOCALIZATION OF THE SCIATIC NERVE IN THE GLUTEAL REGION

USING SURFACE PROJECTIONS: A CADAVERIC STUDY

TAYLOR P. CRAIG, B.S.

____

Rustin Reeves, Ph.D., Major Professor

____

Cara Fisher, Ph.D., Committee Member

____

Armando Rosales, MD, Committee Member

____

Howe Liu, MD, MPT, Ph.D., Committee Member

____

Johnathan Tune, Ph.D., Department Chair

____

Caroline Rickards, Ph.D., Graduate Advisor

____

Michael Mathis, Ph.D., Ed.D., M.H.A., Dean
School of Biomedical Sciences

LOCALIZATION OF THE SCIATIC NERVE IN THE GLUTEAL REGION USING SURFACE PROJECTIONS: A CADAVERIC STUDY

PRACTICUM REPORT

Presented to the Graduate Council of the

School of Biomedical Sciences

University of North Texas

Health Science Center at Fort Worth

in partial fulfillment of the requirements

For the Degree of

MASTER OF SCIENCE

By

Taylor Prescott Craig

Fort Worth, Texas

April 8th, 2022

ABSTRACT

Craig, Taylor., Localizing the Sciatic Nerve in the Gluteal Region Using Surface Projections: A Cadaveric Study. Master Of Science (Medical Sciences Research Track, Anatomy), April 8, 2022, 38pp.; 5 tables, 6 figures, bibliography.

Localization of the sciatic nerve (SN) for pain management commonly relies on ultrasound (US), but that resource may not be available in some rural health clinics and impoverished countries. The purpose of this study is to investigate the use of surface projections within the gluteal region (GR), which are the greater trochanter (GT), ischial tuberosity (IT), and the apex of the sacral hiatus (ASH), to localize the SN and assess sex differences of the SN in orientation to those landmarks. We hypothesize that if the GT, IT, and ASH are reliable in localizing the SN, then we will be able to localize the SN with a reliability greater than or equal to 80%. Using 14 embalmed, OMS-I dissected cadaveric specimens (seven males, seven females), nine different measurements were taken using a digital caliper to establish the orientation of the SN to the GT, IT, and ASH within the GR. Using this data, two reference points (one superior: one inferior) for the SN were identified on the left and right GR of 10 fresh frozen cadavers (five males, five females). Pink latex was injected at the superior point; blue latex at the inferior point, followed by a simple gluteus maximus muscle dissection to verify the location of the latex to the SN. A Welch's t-test was used to analyze any sex differences between the left and right GR, and a Student t-test was used to compare the left and right GR within each sex. There was no significant difference between the nine measurements found within each sex; however, between each sex, there were several measurements that displayed significant differences. Latex injected into the superior point proved better for localizing the SN without using US. Although there were significant differences in the SN measurements between the sexes, the study showed that

these three bony landmarks could locate the sciatic nerve accurately. This method could provide clinicians who lack the resources of US or other imaging modalities to localize the SN reliably.

ACKNOWLEDGMENTS

I want to set aside a small portion of this paper to express gratitude for several individuals whose contribution to my education during this last year in the Medical Sciences Research Tract program is invaluable. First, I was to thank Dr. Caroline Rickards for her guidance in the process of developing sound scientific research. Her easy-going manner and expertise made this learning experience exciting and enlightening. Next, I would like to thank my advisory committee, Dr. Rustin Reeves, Dr. Cara Fisher, Dr. Armando Rosales, and Dr. Howe Liu. Their knowledge and insights significantly contributed to my growth as a lifelong learner over the past year. I am grateful for their dedication to help me with this project, even if that meant showing up to the lab on the weekend. I want to thank my graduate advisor Dr. Scott Maddux, whose wisdom on statistics was irreplaceable. I would also like to thank the Willed Body Program at UNTHSC. They set up every lab experiment and provided all the necessary equipment that made this research possible. Finally, I would like to thank the donors. I do not have the words to honor your gift to science and my research. All I can say is that I am humbled by your generosity and contribution to the world. Without all of the donors and individuals listed, this research project and report would not have been possible.

I dedicate this practicum report to my family in honor of their unconditional love and support through each of my endeavors and earning this degree. Because of you, I have had a wonderful life and many opportunities that would not have been possible on my own. Your selflessness and endless encouragement helped me achieve each academic milestone

in my life. The ability to chase my dreams has been possible only through you. You are the gift that keeps on giving. Thank you.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I: INTRODUCTION TO THE STUDY

The following practicum report was performed as a requirement for the Master of Science Research Tract (Anatomy Track), From May 2021-May 2022, at the University of North Texas Health Science Center (UNTHSC). The study was conducted under the direct supervision of Rustin Reeves, Ph.D., in the Center for Anatomical Sciences and Department of Physiology and Anatomy at UNTHSC.

The sciatic nerve (SN) is one of the largest nerves in the human body and innervates the majority of the lower extremity, excluding the medial leg and foot. The nerve arises from the L4-S3 ventral rami from the sacral plexus and is formed in the gluteal region[4]. The SN is a nerve that often splits into the tibial nerve (TN) and the common fibular nerve (CFN), often referred to as the common peroneal nerve. The anatomy of the SN has considerable variation in relation to the piriformis muscle in the gluteal region and in the popliteal region where it separates into the CFN and TN. The gluteal region is a high-density area consisting of multiple muscles, nerves, major blood vessels, fascia, and lymphatics. Clinically, this site is frequently used for performing injections, surgery, or imagining for nerve entrapment pathologies[4]. Therefore, to avoid potential injury to the SN during these medical procedures, investigating methods that may improve the localization of this SN would benefit both clinicians and patients.

It became very clear in the beginning of the literature search that localizing the SN without imaging modalities was not a point of emphasis within the literature. Therefore, most of the techniques used to localize the SN were not useful without those imaging techniques. Through my investigation, I found that the SN is commonly located in four ways. These include the gluteal, subgluteal, anterior or inguinal, and the popliteal approaches.

However, they did provide very useful information regarding what landmarks may be useful in the study.

The purpose of this practicum is to investigate and localize the SN in the gluteal region using surface projections in human specimens. Specifically, the posterior aspect of the greater trochanter (GT), ischial tuberosity (IT), and the apex of the sacral hiatus (ASH) will serve as landmarks to localize the SN. In addition, analyzing the presentation of the SN relative to the sex of the specimen. The presence of latex on the SN will confirm the reliability of localization. While the localization of nerves using imaging modalities is well characterized, the usefulness of surface projections alone to localize peripheral nerves is less clear, as well as the implications of sex differences on the SN.

CHAPTER II: BACKGROUND AND LITERATURE

Section 1: Anatomy of the Sciatic Nerve

The SN originates from the anterior and posterior divisions of the L4-S3 ventral rami of the sacral plexus[9]. Typically, the SN enters the gluteal region via the greater sciatic foramen inferior to the piriformis muscle and deep to the gluteus maximus muscle. In the posterior thigh, the nerve descends deep to the long head of the biceps femoris muscle[10]. Typically, near the apex of the popliteal fossa, the SN bifurcates into the CFN and TN[10]. The TN passes superficially through the popliteal fossa, diving deep to the soleus muscle to enter the posterior leg[10]. The TN continues to run inferiorly through the posterior compartment of the leg and terminates distal to the flexor retinaculum, where it gives rise to the medial and lateral plantar nerves[10]. The CFN follows the distomedial border of the biceps femoris tendon to descend down over the posterior aspect of the fibular head and then winds around the neck of the fibula deep to the fibularis longus muscle where it divides into the deep and superficial fibular nerves (DFN and SFN)[10].

At the proximal end of the fibularis longus muscle the DFN passes inferoanteriorly, deep to the extensor digitorum longus, and meets the anterior tibial artery and vein at the upper third of the anterior interosseous membrane, forming the neurovascular bundle of the anterior leg. This bundle travels inferiorly, passing anteriorly to the talocrural joint, where the DFN divides into its terminal medial and lateral branches. The medial branch supplies sensory information to the small area between 1st and 2nd toes[10].

The superficial fibular nerve (SFN) runs inferiorly between the fibularis longus and fibularis brevis muscles along the lateral aspect of the fibula. In the middle third of the leg, the SFN reaches the anterior border of the fibularis brevis and pierces the deep fascia surrounding the lateral compartment. It then continues inferiorly, with its terminal branches spanning out onto the dorsum of the foot.[10]

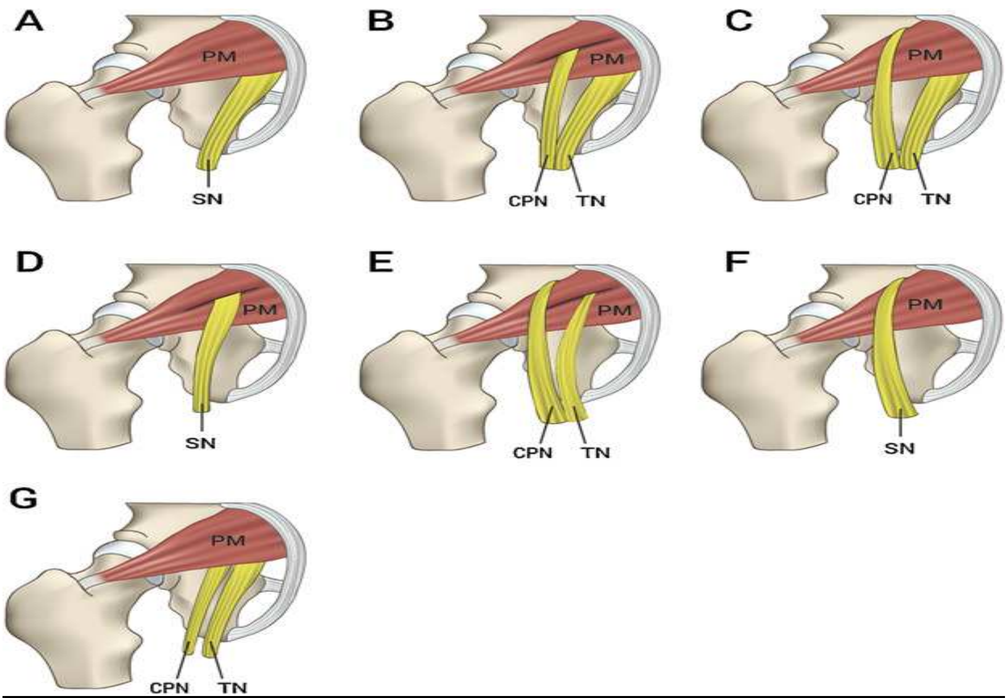
Section 2: Function of the Sciatic Nerve

The SN provides both sensory and motor innervation to the majority of the lower extremity via its two divisions or two terminal branches (tibial and common fibular). The motor fibers of the SN innervate the posterior compartment of the thigh, the entire leg, and the entire foot[10]. The sensory fibers in the SN carry signals from the skin of the foot and the leg, except for the medial leg and foot[9]. The tibial division of the sciatic nerve innervates all posterior thigh muscles with the exception of the short head of the biceps femoris, which is supplied by the common fibular division of the sciatic nerve[10]. The TN provides motor output to the posterior compartment of the leg. The medial and lateral plantar nerves, as terminal branches of the TN, supply motor and sensory innervation to the plantar aspect of the foot[9]. The superficial fibular nerve is motor to the lateral compartment of the leg and carries sensory information from the lateral aspect of the leg and the majority of the dorsum of the foot[9]. The deep fibular nerve carries sensory information from the skin between the first and second digits of the foot and motor innervation to the intrinsic muscles on the dorsum of the foot. Finally, collateral branches from both the CFN and TN carry sensory information from the posterior leg and a portion of the lateral aspect of the foot[9].

Section 3: Variations of the Sciatic Nerve

The SN typically exits the greater sciatic foramen without differentiation of the tibial and fibular divisions and it runs inferiorly underneath the piriformis muscle (PM). However, there are many variations of how the SN exits the greater sciatic foramen. Such variations were first categorized by Beaton and Anson in 1937[11](**Figure 1**). Type A is the most common morphological pattern, where the SN passes below the PM intact. The rest of the morphological variants observed involve the CFN and TN dividing and exiting through or above the PM. The variations of the SN in relation to the piriformis muscle depicted in **Figure 1** are classified in **Table 1**. The results in **Table 2** from Poutoglidou et al, show the analysis of a systematic review on the prevalence of the different morphological patterns. Additionally, further analysis in **Table 3** from Poutoglidou et al, revealed there are differences in prevalence by geographic location[5]. According to Poutoglidou et al, the most commonly identified morphological variant of the SN is the Type A variant, with a pooled prevalence of 90%[5]. The rest of the variant pooled prevalence is about 13% [5]. Type B pattern occurs in 8%, Type C in 2%, and Type D in 1%. Unfortunately, there is very little data collected on the other patterns. Therefore, they are often excluded or not reported on.

Figure 1. Anatomical Variations of the Sciatic Nerve



Journal of Orthopaedic Research, Volume: 34, Issue: 10, Pages: 1820-1827, First published: 09 February 2016,

DOI: (10.1002/jor.23186)

Morphological Patterns	Description
Type A	The SN exits united inferior to the piriformis
Type B	SN divides before the it passes the piriformis, and one portion exits through the piriformis and the other inferior to it
Type C	SN divides before the piriformis, one portion exits superiorly to the piriformis, and the other inferiorly to it
Type D	The SN remains undivided but passes through the piriformis
Type E	The SN divides before the piriformis, one portion passes superiorly to the piriformis, and the other passes through it
Type F	The SN exits united and passes superiorly to the piriformis
Type G	The SN divides before the piriformis and both portions pass inferiorly to the piriformis

Table 1. The Morphological Patterns of the Sciatic Nerve

Journal of Orthopaedic Research, Volume: 34, Issue: 10, Pages: 1820-1827, First published: 09 February 2016,

DOI: (10.1002/jor.23186)

Author	Year of	Country of population orig	Sample s	Type A, n (%)	Type B, n (%)	Type C, n (%)	Type D, n (%)	Type E, n (%)	Type F, n (%)	Total variations, n (%)
Paterson [6]	1893	Scotland (Europe)	23	20 (87%)	3 (13%)	-	-	-	-	3 (13%)
Parsons and Keith [7]	1897	England (Europe)	138	118 (85.5%)	17 (12.3%)	3 (2.1%)	-	-	-	20 (14.4%)
Bardeen [8]	1901	USA	246	220 (89.4%)	25 (10.2%)	1 (0,4%)	-	-	-	26 (10.6%)
Trotter [9]	1932	USA	464	400 (86.2%)	-	-	-	-	-	64 (13.8%)
Beaton and Anson [3]	1937	USA	240	216 (90%)	17 (7%)	5 (2%)	2 (0.8%)	-	-	24 (10%)
Ming-Tzu [10]	1941	China (East Asia)	140	92 (65.7%)	46 (32.9%)	-	2 (1.4%)	-	-	48 (34.3%)
Misra [11]	1954	India	300	262 (87.3%)	18 (6%)	12 (4%)	8 (2.7%)	-	-	38 (12.6%)
Kubota et al. [12]	1960	Japan (East Asia)	38	33 (86.8%)	-	5 (13.2%)	-	-	-	5 (13.2%)
Anson and McVay [13]	1971	USA	2,008	1,789 (89.1%)	201 (10%)	13 (0.6%)	5 (0.2%)	-	-	219 (10.9%)
Nizankowski et al. [14]	1972	Poland (Europe)	200	181 (90.5%)	8 (4%)	3 (1.5%)	5 (2.5%)	3 (1.5%)	-	19 (9.5%)
Lee and Tsai [15]	1974	Taiwan (East Asia)	168	118 (70.2%)	33 (19.6%)	7 (4.2%)	3 (1.8%)	1 (1.5%)	2 (2.9%)	50 (29.8%)
Pećina [16]	1979	Croatia (Europe)	130	102 (78.5%)	27 (20.8%)	1 (0.7%)	-	-	-	28 (21.5%)
Chiba [17]	1992	Japan (East Asia)	511	328 (64.2%)	173 (33.9%)	10 (2%)	-	-	-	183 (35.8%)
Chiba et al. [18]	1994	Japan (East Asia)	442	285 (64.5%)	148 (33.5%)	9 (2%)	-	-	-	157 (35.5%)
Georgiadis et al. [19]	1996	USA	42	40 (95.2%)	2 (4.8%)	-	-	-	-	2 (4.8%)
Gabrielli et al. [20]	1997	Brazil	80	69 (86.2%)	9 (11.3%)	2 (2.5%)	-	-	-	11 (13.7%)
Pokorný et al. [21]	1998	Czech Republic (Europe)	51	41 (80.4%)	7 (13.7%)	2 (3.9%)	1 (2%)	-	-	10 (19.6%)
Uluutku and Kurtoğlu [22]	1999	Turkey	50	37 (74%)	8 (16%)	5 (10%)	-	-	-	13 (26%)
Okraszewska et al. [23]	2002	Poland (Europe)	36	29 (80.6%)	2 (5.6%)	2 (5.6%)	3 (8.3%)	-	-	7 (19.4%)
Fishman et al. [24]	2002	USA	76	65 (85.5%)	-	-	-	-	-	11 (14.5%)
Indrekvam et al. [25]	2002	Norway (Europe)	19	15 (78.9%)	-	-	-	-	-	4 (21.1%)
Benzon et al. [26]	2003	USA	66	65 (98.4%)	1	-	-	-	-	1 (1.6%)
Ndiaye et al. [27]	2004	Senegal (Africa)	20	19 (95%)	-	-	-	-	1 (5%)	1 (5%)
Agur and Dalleya [28]	2005		640	557 (87%)	78 (12.2%)	3 (0.5%)	-	-	-	81 (12.7%)
Ugrenović et al. [29]	2005	Serbia-Montenegro (Europe)	200	192 (96%)	5 (2.5%)	3 (1.5%)	-	-	-	8 (4%)
Pokorný et al. [30]	2006	Czech Republic (Europe)	91	72 (79.1%)	13 (14.3%)	4 (4.4%)	2 (2.2%)	-	-	19 (20.9%)
Chukwuanukwu et al. [31]	2007	Nigeria (Africa)	52	50 (96.2%)	2 (3.8%)	-	-	-	-	2 (3.8%)
Vincente et al. [32]	2007	Brazil	40	34 (85%)	6 (15%)	-	-	-	-	6 (15%)
Pecina et al. [33]	2008	Croatia (Europe)	10	7 (70%)	3 (30%)	-	-	-	-	3 (30%)
Güvencer et al. [34]	2008	Turkey	50	38 (76%)	7 (14%)	4 (8%)		-	-	11 (24%)[b]
Kukiriza et al. [35]	2010	Uganda (Africa)	80	62 (77.5%)				-	-	18 (22,5%)
Brooks et al. [36]	2011	Brazil	40	36 (90%)	-	-	4 (10%)	-	-	4 (10%)
Muthu Kumar et al. [37]	2011	India	50	50 (100%)	-	-	-	-	-	0 (0%)
Ogeng'o et al. [38]	2011	Kenya (Africa)	164	147 (89.6%)	13 (7.9%)	4 (2.4%)	-	-	-	17 (10.4%)
Patel et al. [39]	2011	India	86	81 (94.2%)	5 (5.8%)	-	-	-	-	5 (5.8%)
Sabnis [40]	2012	India	140	139 (99.3%)	-	1 (0.7%)	-	-	-	1 (0.7%)
Delabie et al. [41]	2013	France (Europe)	104	94 (90.4%)	10 (9.6%)	-	-	-	-	10 (9.6%)
Prathiba et al. [42]	2013	India	100	92 (92%)	3 (3%)		1 (1%)	-	-	4 (4%)
Adibatti and Sangeetha [43]	2014	India	50	47 (94%)	-	-	-	-	-	3 (6%)
Desalegn and Tesfay [44]	2014	Ethiopia (Africa)	36	33 (91.7%)	2 (5.6%)	-	-	-	-	2 (5.6%)[c]
Gomes et al. [45]	2014	Brazil	40	35 (87.5%)	5 (12.5%)	-	-	-	-	5 (12.5%)
Natsis et al. [46]	2014	Greece (Europe)	294	275 (93.5%)	12 (4.1%)	1 (0.3%)	1 (0.3%)	-	1 (0.3%)	14 (4.7%)[d]
Sulak et al. [47]	2014	Turkey	400	392 (98%)	5 (1.3%)	3 (0.8%)	-	-	-	8 (1.9%)
Lewis et al. [48]	2016	USA	102	90 (88.2%)	9 (8.8%)	3 (2.9%)	-	-	-	12 (11.8%)
	Total	8,257	7,067	923	106	37	4	4	1,177	
	Total prevalence (confidence interval)		90% (83-	8% (5-10%)	2% (0-3%)	1% (0-2%)			13% (10-16%)	

Table 2. Characteristics of the Cadaveric Studies

[a]No data reported with respect to geographic region. [b]Data missing from one specimen. [c]One additional variant not described in Beaton and Anson classification. [d]Four additional variants not described in Beaton and Anson classification: a variant with a PM with three muscle bellies and a CPN passing between superficial and intermediate muscle belly and the deep muscle belly passing through the TN; a variant in which the CPN passed between the two bellies of a double-headed PM and the TN passed below the PM; and two variants in which the SN passed below the PM and a supernumerary muscle located just superior to the PM (in the suprapiriform foramen) Note: types E and F were excluded from the meta-analysis due to the limited number of studies that included them

Sciatic Nerve Variants and the Piriformis Muscle: A Systematic Review and Meta-Analysis, Poutoglidou, F., Piagkou, M., Totlis, T., Tzika, M., & Natsis, K., *Cureus*, *12*(11)

Geographic Region	Type A	Type B	Type C	Type D	Total variations
Turkey	85% (CI: 60-100%)	9% (CI: 0-31%)	2% (CI: 0-3%)	0% (CI 0-9%)	14% (CI: 0-38%)
Europe	88% (CI: 81-91%)	9% (CI: 6-14%)	2% (CI: 0-4%)	1% (CI 0-3%)	14% (CI: 9-19%)
USA	95% (CI: 84-96%)	4% (CI: 1-9%)	1% (CI: 0-3%)	0% (CI: 0-2%)	11% (CI: 9-13%)
Brazil	89% (CI: 76-95%)	8% (CI: 2-18%)	1% (CI: 0-5%)	2% (CI: 0-6%)	13% (CI: 9-19%)
India	97% (CI: 90-99%)	2% (CI: 0-6%)	1% (CI: 0-3%)	1% (CI: 0-3%)	4% (CI: 1-9%)
East Asia	73% (CI: 59-79%)	24% (CI: 14-33%)	3% (CI: 0-7%)	1% (CI: 0-3%)	31% (CI: 26-37%)
Africa	95% (CI: 82-95%)	3% (CI: 0-8%)	1% (CI: 0-4%)	0% (CI: 0-2%)	10% (CI: 5-17%)
Total	90% (CI: 83-90%)	8% (CI: 5-10%)	2% (CI: 0-3%)	1% (CI: 0-2%)	13% (CI: 10-16%

Table 3. Subgroup analysis by geographic region

Sciatic Nerve Variants and the Piriformis Muscle: A Systematic Review and Meta-Analysis, Poutoglidou, F., Piagkou, M., Totlis, T., Tzika, M., & Natsis, K., *Cureus*, *12*(11)

Section 4: Localizing the Sciatic Nerve

One of the most common methods of localizing the SN is by the use of ultrasound (US) for the purpose of conducting a SN block. There are many different techniques employed to locate the nerve with the use of US. The techniques vary by regional anatomical location. The locations include the gluteal, subgluteal, anterior or inguinal, and popliteal regions. Typically, a Curvilinear probe is used with a frequency range of 2-5 MHz[1]. Additionally, the patient is often oriented in different positions to make the SN more accessible at the selected anatomical location.

A very common approach of the gluteal region involves the Sim's position where the hip and knee are flexed and the procedural site is uppermost[7,1]. Using this method, the posterior superior iliac spine, sacral hiatus, and the greater trochanter are marked[7]. The sonographic probe is then placed in between the three points to localize the SN. The SN in this position has been found to be about 3.5 cm deep to the surface of the skin[1].

The subgluteal approach places the subjects in the same position as described for the gluteal region approach[13]. The lateral prominence of the greater trochanter and the ischial tuberosity are identified and marked[12]. The probe is then positioned at the midline and just lateral to the line drawn between the two landmarks[12]. In this approach the SN is between 3-3.5 cm deep to the surface of the skin.

A third common one is the anterior approach, which involves the patient laying supine[,2]. With the patient in the supine position, the lower limb is partially flexed and externally rotated. This moves the lesser trochanter laterally, which allows the SN to become easily accessed[7]. For this approach the SN is found to be between 5-7 cm deep to the surface.

Additionally, this positions the patient so the major vasculature is out of the way during injections[1].

The final approach is the popliteal approach, which involves the patient typically positioned prone[7]. However, the patient could also be positioned supine or laterally. In the popliteal region the SN is divided into the CFN laterally and the TN medially[13]. During this approach, the SN is about 1.5 to 2.5 cm deep to the surface. In this space the major vasculature is deep to the nerves, which allows for easy access. To localize the SN, clinicians will find the surface landmarks of the popliteal triangle, which are the tendons of semitendinosus and semimembranosus muscles medially, the tendon of the biceps femoris muscle laterally, and the popliteal crease inferiorly[13].

CHAPTER III: SPECIFIC AIMS

Specific Aim 1: To determine if there is a significant difference in the presentation of the SN within each specimen or between the sexes. Specifically, in the width of the SN and the distances from the GT, IT, ASH to the SN.

Hypothesis 1- We hypothesize there will be no significant difference in the width of the SN or the distances from the GT, IT, and ASH to the SN within specimens. However, when separated by sex, there will be significant differences between specimens.

Specific Aim 2: To determine if the greater trochanter, ischial tuberosity, and apex of the sacral hiatus can be used to localize the SN with a high reliability.

Hypothesis 2- If the GT, IT, and ASH are reliable in localizing the SN, then we will be able to localize the SN with a reliability greater than or equal to 80% in both sexes.

CHAPTER IV: SIGNIFICANCE

Our understanding of the location of the SN is well understood in the literature with the use of imaging modalities such as US and magnetic resonance neurography (MRN)[6]. Previous studies on localizing the SN have primarily used imaging modalities with surface projections as an aid, but not on the utility of surface projections alone or sex differences in SN presentation. Typical techniques do not include the apex of the sacral hiatus, greater trochanter, and ischial tuberosity in combination. As a result, there is little information on the usefulness of surface projections to localize the SN without US and MRN or the implication of sex on the presentation of the SN. Therefore, it is not clear if this particular combination of surface projections is equally valid or if sex affects the presentation of the SN.

Additionally, there are many settings in which advanced imaging modalities, like US and MRN, are not available, but it is still necessary to localize the SN. Also, the average pelvic/extremity US can range in cost from $260-1300, which is can be significant cost to a patient. Finally, clinicians such as physical therapists and doctors of osteopathic medicine practice manual manipulative techniques, which depend on surface projections to localize various aspects of the body. Therefore, creating a method that can potentially improve the localization of a major peripheral nerve may improve diagnosis and treatment considerations, and potentially reduce the cost of healthcare for patients. Thus, the present study will attempt to address this in the literature.

CHAPTER V: MATERIALS AND METHODS

Subjects

Each cadaveric specimen was provided by the University of North Texas Health Science Center's Willed Body Program. The total sample size was 24 specimens, 12 males and 12 females. In the first part of this project, we used a total of 14 specimens, seven male and seven female, that were embalmed and dissected by first year TCOM students. The part of this study included 10 specimens, five male and five female, that were fresh frozen to prevent rigidity of the limbs, maintain tissue pliability, and allow for injections without having the anatomy previously disrupted. The demographic information of interest is the sidedness of the extremity and the sex of the specimen.

Protocol/Instrumentation

All subjects were positioned prone on a flat surface with the gluteal region exposed. The embalmed specimens were used following a TCOM dissection-based anatomy course. A T-pin was used to identify each landmark, and measurements were taken from T-pin to T-pin. A VINCA digital caliper was used to measure the distances between each pin in centimeters. Additionally, the relationship of the SN to the PM was noted. These initial measurements were used to standardize the location of injection during the second phase of the experiment. Interrater reliability was established by having an individual blinded to the study perform measurements on two different subjects that had previously been assessed by myself.

The fresh frozen specimens had each landmark noted by a T-pin. One experimenter used the measurements found from the embalmed specimens to localize the SN on the fresh specimens. The GTi-Med SN and the IT-Lat SN established the inferior line, and the GTs-Med SN and the ASH-Lat SN established the superior line. Then each injection site was established by the midpoint between each of the established lines. Then two different experimenters would inject either pink or blue latex with a 22-gauge needle projected location of SN. In this experiment pink latex was injected at the superior injection site and blue latex was injected at the inferior injection site. Following the injection, each specimen underwent a simple gluteal dissection to reveal the exact location of the latex. This dissection was done by incising the skin at the iliac crest to the gluteal fold, through the superficial fascia, and gluteus maximus muscle The dissection was performed by using a scalpel with a no. 22 blade and scissors. Finally, one experimenter was assigned to a limb to assess if the latex was present on the SN. If it was, it was marked as a hit and if it was in any other location, it was recorded as a miss.

Data Collection and Analysis

The data collected includes the measurements taken from the GT to the IT, the GT to the ASH, and the ASH to the IS. These measurements establish the borders of the area where the injections took place. Additionally, measurements from each landmark to the SN, and the width of the SN itself were also taken. Each measurement was measured in centimeters to the nearest thousands place. The means found were compared by a paired sample *t*-test for within sex comparisons, and a Welch's t-test for between sex comparisons. To establish the overall reliability of the injection to correctly locate the SN we divided the number of hits by total number of injections, and assessed this data by injection site, extremity, and sex.

CHAPTER VI: Results

Subjects

In the first part of this experiment there was a total of 14 subjects (seven female, seven male) each with a right and left lower extremity (RLE and LLE) for a total of 28 gluteal regions for comparison in the within and between sex comparisons. No subjects were excluded in this study.

In the second part of this experiment there were 10 fresh frozen specimens five female and five male subjects. For a total of 20 gluteal regions and 40 injection sites for comparison. However, the left gluteal region of one of the specimens was excluded because the latex failed to eject from the syringe.

Within Sex Comparison

In the within group comparison no significant difference was found between the right lower extremity (RLE) and left lower extremity (LLE) in both males. The average difference between the means for males was 1.4 millimeters, and for females was 0.6 millimeters. The mean of the measurement ASH- GT in males was 14.100 ± 0.48 cm and reported the lowest P-value (LLE, 14.164 ± 0.45 cm; RLE, 14.036 ± 0.54 cm; P= 0.06, **Table 4**). The mean for the IT-GT in males was found to be 7.357 ± 0.94 and reported the highest calculated P- value (LLE, 7.365 ± 1.05 cm; RLE, 7.350 ± 0.89 cm; P= 0.93, **Table 4**). The mean for the ASH-IT in males was found to be 9.474 ± 0.80 cm (LLE, 9.491 ± 0.73 cm; RLE, 9.458 ± 0.92 cm; P= 0.87, **Table 4**). The rest of the data reported for the LLE and RLE of males can be found in **Table 4**, and the graphical representation of the data can be found at the end of the practicum report (**Appendix C**).

Similarly, no significant difference was found in any measurement category when comparing the LLE to RLE in females. The mean of the measurement for the width of the SN (W SN) was found to be 1.275 ± 0.15 cm in females and reported the lowest calculated P-value (P= 0.44, **Table 5**). The mean of the measurement IT-Med SN was found to be 2.391 ± 0.38 cm and reported the highest calculated P- value (P= 0.98, **Table 5**). The rest of the data reported for the LLE and RLE of females can be found in **Table 5**, and the graphical representation of the data can be found at the end of the practicum report (**Appendix C**).

Table 4. Anatomical Measurements: Male means

	Total (n=14)	LLE (n=7)	RLE (n=7)	P- Value
ASH-GT	14.100 ± 0.48	14.164 ± 0.45	14.036 ± 0.54	0.06
ASH-IT	9.474 ± 0.80	9.491 ± 0.73	9.458 ± 0.92	0.87
IT-GT	7.357 ± 0.94	7.365 ± 1.05	7.350 ± 0.89	0.93
IW of SN	1.275 ± 0.08	1.279 ± 0.10	1.271 ± 0.05	0.75
GTi-Lat SN	3.445 ± 0.80	3.388 ± 0.91	3.503 ± 0.74	0.61
IT-Med SN	2.540 ± 0.51	2.567 ± 0.40	2.514± 0.63	0.77
ASH-Med SN	8.261 ± 0.66	8.218 ± 0.61	8.304± 0.75	0.66
GTs- SN	4.064 ± 0.92	3.792 ± 1.00	4.336± 0.82	0.07
SW of SN	1.705 ± 0.37	1.860 ± 0.41	1.550± 0.26	0.14

All data represented as mean ± SD in centimeters (cm). Paired t-tests were applied to compare the means of the left lower extremiy (LLE) to the right lower extremity (RLE) of male subjects. Greater trochanter to ischial tuberosity (GT-IT); apex of the sacral hiatus to ischial tuberosity (ASH-IT); apex of the sacral hiatus to medial border of sciatic nerve (ASH-Med SN); greater trochanter inferior line to lateral border of sciatic nerve (GTi- Lat SN); greater trochanter superior line to lateral border of sciatic nerve (GTs-Lat SN); ischial tuberosity to greater trochanter (IT-GT); ischial tuberosity to medial border of sciatic nerve (IT- Med SN); superior line width of the sciatic nerve (SW of SN); inferior line width of the sciatic nerve (IW of SN).

Table 5. Anatomical Measurments: Female means

	Mean (n=14)	LLE (n=7)	RLE (n=7)	P-Value
ASH-GT	13.142	13.117	13.168	0.86
ASH-IT	9.997	10.021	9.974	0.55
IT-GT	6.157	6.187	6.127	0.70
W SN	1.039	1.053	1.025	0.44
GT-Lateral SN	2.649	2.688	2.609	0.53
IT-MEDS	2.391	2.395	2.388	0.98
ASH-MedS	8.977	9.017	8.937	0.36
GTs-Lat SN	3.207	3.301	3.112	0.58
Sup. W SN	1.307	1.291	1.323	0.53

All data represented at mean ± SD. Paired t-tests were applied to compare the means of the left lower extremiy (LLE) to the right lower extremity (RLE) of female subjects. Greater trochanter to ischial tuberosity (GT-IT); apex of the sacral hiatus to ischial tuberosity (ASH-IT); apex of the sacral hiatus to medial border of sciatic nerve (ASH-Med SN); greater trochanter inferior line to lateral border of sciatic nerve (GTi- Lat SN); greater trochanter superior line to lateral border of sciatic nerve (GTs-Lat SN); ischial tuberosity to greater trochanter (IT-GT); ischial tuberosity to medial border of sciatic nerve (IT- Med SN); superior line width of the sciatic nerve (SW of SN); inferior line width of the sciatic nerve (IW of SN).

Between Sex Comparison

There were several differences appreciated when comparing the distances of the landmarks to the SN and the width of the SN itself with in the gluteal. The anatomical measurements within the gluteal region that involved the GT including GT-IT ($P \leq 0.001$, **Figure 2**), ASH-GT ($P \leq 0.001$, **Figure 2**), GT- Lat SN ($P \leq 0.01$, **Figure 2**), GTs-Lat SN ($P \leq 0.05$, **Figure 2**) all displayed significant differences between the sexes. The width of the SN at the lower border LW of SN ($P \leq 0.0001$, **Figure 2**) and SW of SN ($P \leq 0.01$, **Figure 2**) showed significant differences between the sexes. However, no significant differences were appreciated in the measurements ASH-IT ($P= 0.21$, **Figure 2**) and IT-Med SN ($P= 0.386$, **Figure 2**).

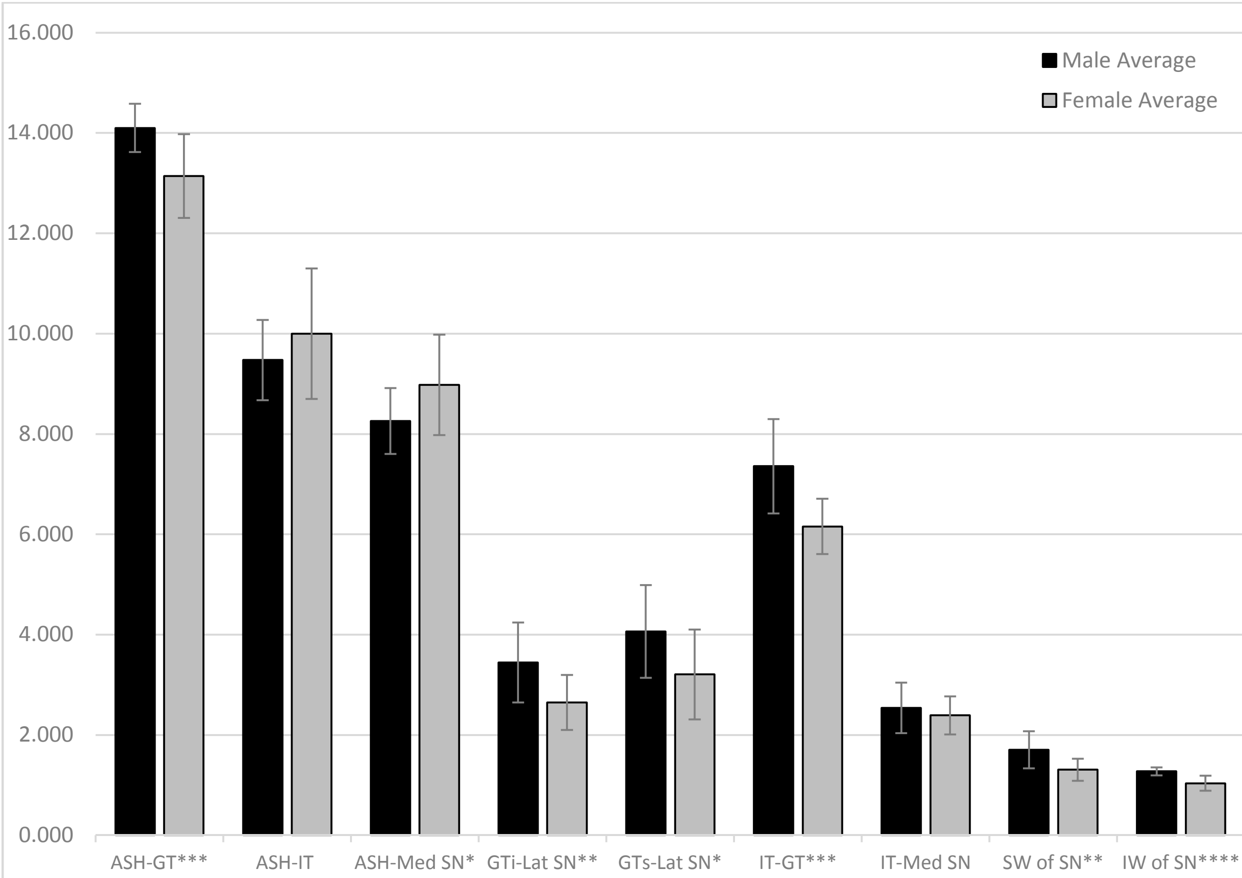


Figure 2. Means of both male and female subjects with the error bars representing SD. Greater trochanter to ischial tuberosity (GT-IT); apex of the sacral hiatus to ischial tuberosity (ASH-IT); apex of the sacral hiatus to medial border of sciatic nerve (ASH-Med SN); greater trochanter inferior line to lateral border of sciatic nerve (GTi- Lat SN); greater trochanter superior line to lateral border of sciatic nerve (GTs-Lat SN); ischial tuberosity to greater trochanter (IT-GT); ischial tuberosity to medial border of sciatic nerve (IT- Med SN); superior line width of the sciatic nerve (SW of SN); inferior line width of the sciatic nerve (IW of SN). (****= $P \leq 0.0001$, ***= $P \leq 0.001$, **= $P \leq 0.01$, *= $P \leq 0.05$)

Localization of the Sciatic Nerve

The SN was identified on average 82% (**Figure 3-A, B, C)** of the time with in the gluteal region. The SN was identified with latex in the GT-ASH injection site 12 out of 14 times (86%, **Figure 3-A**) and in the GT- IT injection site 11 out of 14 times (79%, **Figure 3-A**). When analyzing by extremity the SN was identified with latex 11 out of 14 times (79%, **Figure 3-B**) in the RLE and 12 out of 14 times (86%, **Figure 3-B**) in the LLE. In females the SN was identified with latex 13 out of 16 times (81%, **Figure 3-C**) and 10 out of 12 times (83%, **Figure 3-C**) in males.

Additionally, we analyzed the localization data by comparing injection site and extremity within each sex. Males reported a higher localization percentage at the GT-ASH injection site (90%, **Figure 4-A**) comparted to the GT-IT injection site (70%, **Figure 4-A**), for an average of 80%. Males reported an equivalent localization percentage (80%, **Figure 4-C**) in both the RLE and LLE. Females reported a higher localization along the GT-ASH injection site (89%, **Figure 4-B**) compared to the GT-IT injection site (78%, **Figure 4-B**), for an average of 83%. Lastly, females also reported a higher percentage of localization in the LLE (89%, **Figure 4-D**) compared to the RLE (80%, **Figure 4-D**).

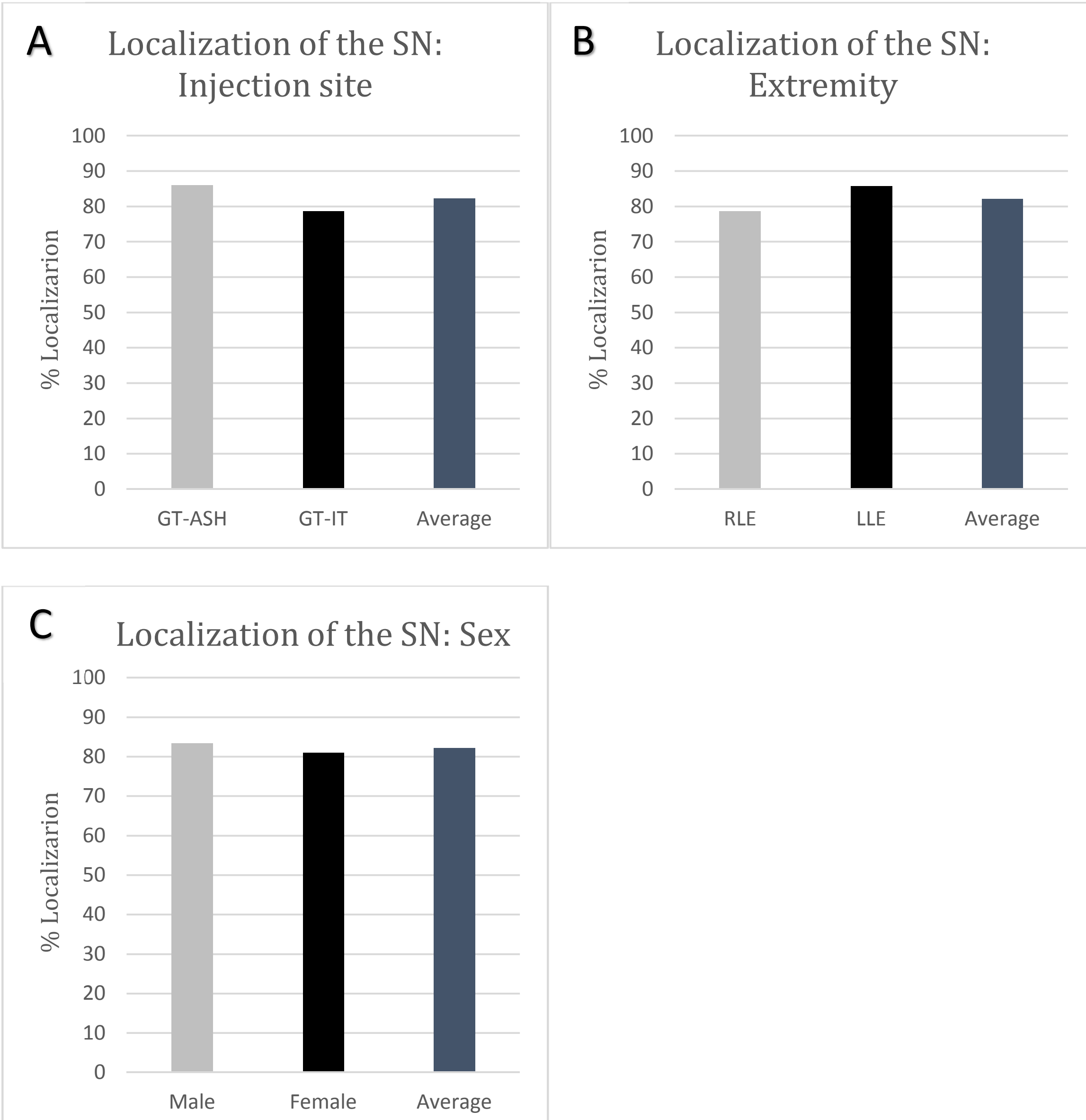


Figure 3. Localization of the Sciatic Nerve. Each bar represents the number of hits divided by total injections as a percentage (GT-ASH; GT-IT; Panel A), by extremity (RLE, LLE; Panel B), and sex (Male, Female; Panel C)

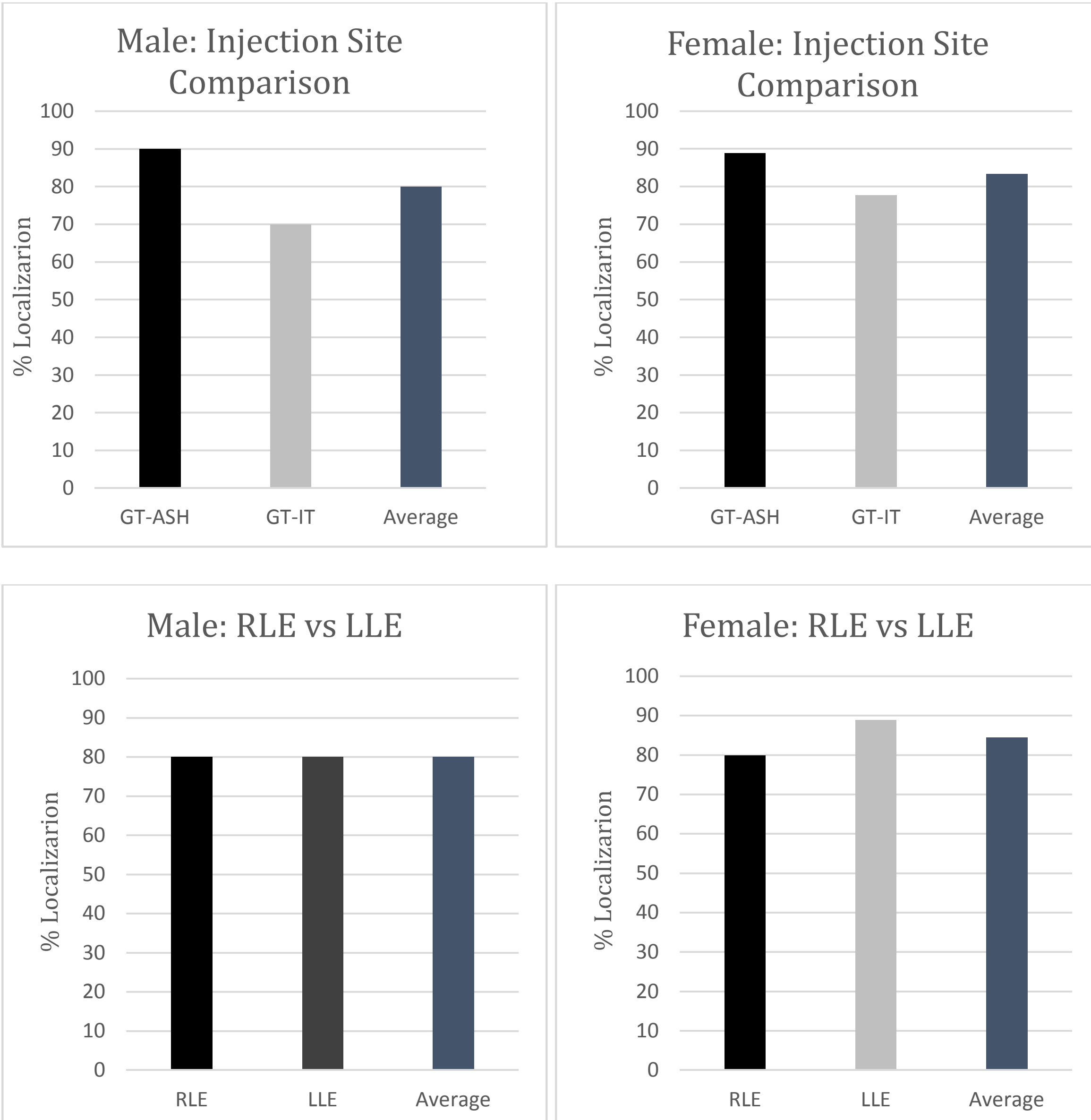


Figure 4. Localization of the Sciatic Nerve: Male and Female. Each bar represents the number of hits divided by total injections as a percentage: By injection site (GT-ASH; GT-IT) males (Panel A) and females (Panel B), and by extremity (RLE, LLE) for males (Panel C) and females (Panel D).

CHAPTER VII: DISCUSSION

In this study, we evaluated the ability of surface projections within the gluteal region to localize the SN in that region. Additionally, we evaluated if sex affected the width of the SN itself and the distances from the GT, IT, and ASH. The key findings of this study are: 1) There is no difference in the width of the SN or in the orientation of the nerve in the gluteal region between the left and right extremities of the same sex. 2) Sex appears to have an effect on the width of the SN and on the distances of the SN to the GT and ASH, but not to the IT. 3) The SN can be localized in the gluteal region reliably using the GT, IT, and the ASH.

This study found that, when comparing the LLE and RLE within the same sex, there is no significant difference between the width of the SN and the distances to the IT, GT, and ASH. This study looked at nine different anthropomorphic measurements within the gluteal region. The average difference between the means of the LLE and RLE in males was 1.4 millimeters and for females was 0.6 millimeters. The lack of significant difference found statistically and the minute difference between the means of both sexes demonstrates that the SN will develop similarly within the gluteal region. Further, a standardized distance from the IT, GT, and ASH can be applied to locate the SN in different individuals of the same sex. Additionally, the SN can be expected to be a similar width throughout the gluteal region in individuals of the same sex. All of the evidence found in this study seems to verify that the LLE and RLE of the same sex have very little difference between them, in regards to the location of the SN within the GR.

The study found that males and females differed in seven of nine anthropomorphic measurements in the gluteal region. Specifically, Males and females demonstrated significant differences in all of the measurements involving the GT. The measurements involving the GT are the GT-IT (P ≤ 0.001, **Figure 2**), ASH-GT (P ≤ 0.001, **Figure 2**), GTi- Lat SN (P ≤ 0.01, **Figure 2**), GTs-Lat SN (P ≤ 0.05, **Figure 2**). Additionally, the average difference between the means of males and females was 0.65 centimeters (65 millimeters). Suggesting that the SN orientation to the GT within the gluteal region is significantly different between the sexes. Both the measurements that measured the width of the SN demonstrated statistical significance LW of SN (P ≤ 0.0001, **Figure 2**) and SW of SN (P ≤ 0.01, **Figure 2**). This suggests that sex has an effect on the size of the SN within the gluteal region and on the distances from the ASH and GT. However, males and females did not demonstrate a significant difference in all measurement categories. Specifically, those that involved the IT and not the GT. Those measurements were the ASH-IT (P= 0.21, **Figure 2**), and IT-Med SN (P= 0.386, **Figure 2**). This seems to suggest that while sex seems to have an effect on the size of the SN and the distances of the SN to the GT and ASH, it does not seem to affect the orientation of the SN to the IT.

The last aim of this study was to use standardized distances from the GT, IT, and ASH to localize the SN at least 80% of the time. In this study we successfully injected a total of 38 times and recorded 31 hits for an average of 82% (**Figure 3- A, B, C**). When separated by sex, we found the SN 83% of the time in Females (**Figure 3-C)** and males 80% in males (**Figure 3-C**). While females reported a higher percentage than males, they reported a lower number of hits at 15 than males, who had 16. The higher percentage is a result of excluding two failed latex injections in the left gluteal region of a single female specimen.

Therefore, the reliability of localization by sex may be equivalent. However, a larger sample size for comparison is necessary to derive a more definitive conclusion about the difference in reliability, if any, between males and females.

Interestingly, this study shows that the ischial tuberosity might be the most reliable landmark within the gluteal region to locate the SN, because there was no significant difference between the sexes from the IT-Med SN. The average difference in the means between the sexes was 0.65 cm, but the difference between means in regards to the IT-Med SN was 1.5 millimeters. However, the data collected in this study suggests that locating the SN along the GT-ASH (89%, **Figure 3-A**) is more accurate than along the GT-IT (74%, **Figure 3-A**). It should be stated that this study encountered zero morphological variants of the SN. The greatest difference in morphological presentation is around the piriformis muscle, potentially affecting clinicians' ability to localize the SN along the GT-ASH border. However, for the purposes of this study no matter how the data was analyzed, the average reported percent localization was over 80%. Therefore, standardized distances can be used to localize the SN within the GR of both sexes at least 80% of the time.

CHAPTER VIII: SUMMARY AND CONCLUSIONS

We examined if the SN was oriented to surface projections differently between the right and left gluteal regions within and between the sexes. This study found no difference in the orientation of the SN to surface projections within the same sex; However, males and females did display several significant differences in the SN orientation to the GT and ASH. Interestingly, this study found no difference between the sexes regarding the orientation of the SN to the IT. Additionally, this study examined if a standardized distance from the GT, ASH, or IT could be applied to locate the SN within the gluteal region at a reliability of 80%. We found a reliability of localization at an average of 82% (**Figure 3-A, B, C**). Therefore, the SN can be located by standardized distances from surface projections in males and females. Investigating the ability of surface projections to locate peripheral nerves may elucidate a reliable way to find certain nerves without the need for advanced imaging modalities. Reducing the need for advanced imaging modalities could alleviate the need for a trained technician to locate the peripheral nerve and reduce the financial cost to patients. With the findings in this study, we can further develop and improve techniques that locate the SN and other peripheral nerves to reduce the cost of patient care, and potentially reduce the chance of misdiagnosis by clinicians.

Limitations

This study has some limitations that future studies should consider. This study featured a sampling method of convenience and relatively small sample size. Both of these affect the generalizability of this study. Next, each pin placed in the embalmed cadavers were assumed to be in the same spot, which was likely impossible. Similarly, the orientation of each lower limb was assumed to be the same. This is potentially problematic because the position of the limb can affect the distances measured from surface projection to the SN. Finally, only one morphological variant was discovered during this study, so the findings may not apply to individuals with an atypical morphological presentation of the SN.

Future Directions

Investigating the ability of surface projections to locate peripheral nerves may elucidate a reliable way to find specific nerves without the need for advanced imaging modalities. The project focused on localizing the SN only in the gluteal region. Future studies could try to locate the SN with surface projections in different lower extremity regions. Other experiments could seek to identify other landmarks within the gluteal region or test to see if only one is needed to localize the SN. It would also be interesting to investigate how surface projections in different regions of the body can localize nearby peripheral nerves. Additionally, investigating the depth of the SN would vastly increase the procedural applicability of localization without advanced imaging. Lastly, future studies should investigate if the reliability to locate the SN with standardized distances is affected by the morphological variants of the SN.

CHAPTER IX: INTERNSHIP EXPERIENCE

My internship practicum was completed at the University of North Texas Health Science Center in Fort Worth, TX, under the supervision of a brilliant research committee, which included Dr. Rustin Reeves, Dr. Cara Fisher, Dr. Armando Rosales, and Dr. Howe Liu. The project was conducted over the last year to achieve my Master's of science degree. This process was a challenging and novel experience for me and would not have been possible without the help of my committee. I met with Dr. Reeves in May of 2021. I discussed my interest in localizing peripheral nerves with surface projections, which Dr. Reeves has experience with on a previous project. Dr. Reeves immediately directed me to contact Dr. Liu, who is also interested in this area. With their help, my research project to localize the SN began, and I was able add two extraordinarily talented anatomists, Dr. Fisher and Dr. Rosales. In early June of 2021, I started my project by diving into literature concerning techniques to localize the SN.

I discovered a heavy reliance on specialized imaging techniques to localize the nerve through my research. Upon learning this, I became concerned that this may limit accessibility to treatments that require the SN to be localized. I brought my concern to my committee and expressed an interest in finding the SN without imaging techniques, and they encouraged me to pursue this idea. I then performed another detailed investigation into the literature and reviewed the anatomy of the gluteal region. I found three prominent landmarks from this search: the GT, IT, and ASH used to localize the SN. However, each study used a combination of the three landmarks, but never all three, and relied on US or MRN. I settled on these landmarks because patient populations consist of various body types, and I wanted landmarks that clinicians could palpate independent of body type. From May 2021 to August 2021, I met regularly with Dr. Reeves to discuss any updates on my literature search and advice on goals for the upcoming week. During this time, I also took the MCAT in June and submitted primary and secondary applications to medical schools for the 2022 admissions cycle. In the following months, from October 2021 to November 2021, I put my research on hold while completing TCOM's structural neuroscience course as an elective. I also had the opportunity to be a TA in anatomy for PT, PA, and OMS1 students. Finally, towards the end of my first semester, from mid-November 2021 to mid-December 2021, I collected the data for the first part of my study on the previously dissected cadavers and defended my proposal privately.

At the beginning of the new year in January 2022 to March 2022, I performed the second part of my experiment and was a TA in anatomy for first-year medical science students. I also drafted this practicum report and prepared my thesis defense presentation during this time. In conclusion of this incredible year, I successfully defended my research publicly on the 8th of April, 2022.

In closing, I want to thank again all those I mentioned in the acknowledgment section at the beginning of this practicum report. I especially want to thank the Willed Body Program at UNTHSC for providing and acquiring all of the donors for this project. I extremely grateful for this experience, and I know that because of this program I will have a sound foundation for all my scientific endeavors.

BIBLIGOGRAPHY

1. Chan, V. W. S., Nova, H., Abbas, S., McCartney, C. J. L., Perlas, A., & Quan Xu, D. (2006). Ultrasound examination and localization of the sciatic nerve. *Anesthesiology*, *104*(2), 309–314. https://doi.org/10.1097/00000542-200602000-00017

2. Kim, H. J., Chin, K. J., Kim, H., Jang, H., Bin, S., Ro, Y., & Koh, W. U. (2020). Ultrasound-guided anterior approach to a sciatic nerve block. *Journal of Ultrasound in Medicine*, *39*(8), 1641–1647. https://doi.org/10.1002/jum.15258

3. Tomaszewski, K. A., Graves, M. J., Henry, B. M., Popieluszko, P., Roy, J., Pękala, P. A., Hsieh, W. C., Vikse, J., & Walocha, J. A. (2016, February 22). Surgical anatomy of the sciatic nerve: A meta-analysis. Wiley Online Library. Retrieved November 2, 20

4. Adibatti, M., & V, S. (2014). Study on variant anatomy of sciatic nerve. *Journal of clinical and diagnostic research : JCDR*, *8*(8), AC07–AC9. https://doi.org/10.7860/JCDR/2014/9116.4725

5. Poutoglidou, F., Piagkou, M., Totlis, T., Tzika, M., & Natsis, K. (2020). Sciatic Nerve Variants and the Piriformis Muscle: A Systematic Review and Meta-Analysis. *Cureus*, *12*(11), e11531. https://doi.org/10.7759/cureus.11531

6. Filler, A. (2009, October). Magnetic resonance neurography and diffusion tensor imaging: Origins, history, and clinical impact of the first 50,000 cases with an assessment of efficacy and utility in a prospective 5000-patient study group. Neurosurgery. Re

7. Sehmbi H, Shah UJ. Ultrasound-guided approaches to sciatic nerveblock. Int J Perioperative Ultrasound Appl Technol 2013; 2:135–137

8. AJ;, K. (2014, May 20). *Variations of the sciatic nerve anatomy and blood supply in the gluteal region: A review of the literature*. ANZ journal of surgery. Retrieved November 2, 2021, from https://pubmed.ncbi.nlm.nih.gov/24842563/.

9. Giuffre BA, Jeanmonod R. Anatomy, Sciatic Nerve. [Updated 2021 Jul 29]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482431/

10. Moore, K. L., R., A. A. M., & Dalley, A. F. (2019). Chapter 7. In *Clinically oriented anatomy* (pp. 721–741). essay, Wolters Kluwer Health.

11. Beaton LE, Anson BJ. 1937. The relation of the sciatic nerve and of its subdivisions to the piriformis muscle. *Anat Rec* 70:1–5.

12. Karmakar MK, Kwok WH, Ho AM, Tsang K, Chui PT, Gin T.Ultrasound-guided sciatic nerve block: description of a new app-roach at the subgluteal space. Br J Anaesth 2007 Mar;98(3):390-395

13. Sinha A, Chan VWS. Ultrasound imaging for popliteal sciatic nerve block. Reg Anesth Pain Med 2004 Mar;29(2):130-134

APPENDIX A: LIST OF ABBRIVIATIONS

Abbreviation	Explanation
ASH	Apex of the Sacral Hiatus
GT	Greater Trochanter
IT	Ischial Tuberosity
MRN	Magnetic Resonance Neurography
PM	Piriformis Muscle
SN	Sciatic Nerve
TN	Tibial Nerve
US	Ultrasonography
GR	Gluteal Region
CPN	Common Peroneal Nerve
CFN	Common Fibular Nerve
LLE	Left Lower Extremity
RLE	Right Lower Extremity
Med	Medial
Lat	Lateral

APPENDIX B: ADDITIONAL GRAPHS

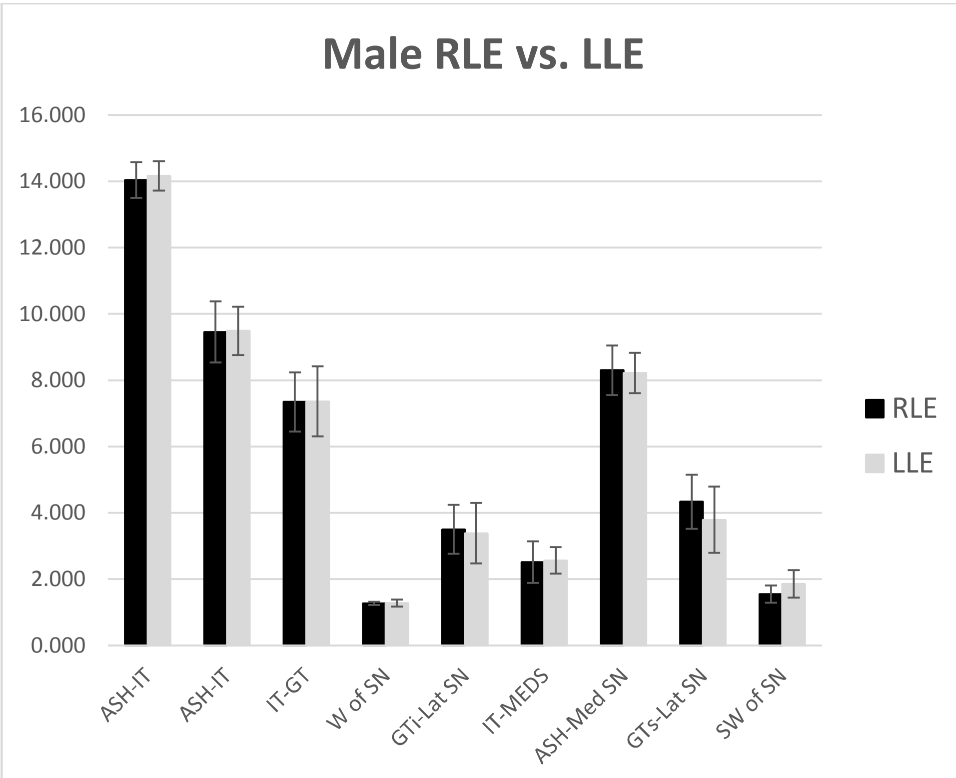


Figure 5. All data represented as means in centimeters (cm). Standard error bars represent SD. Paired t-tests were applied to compare the means of the left lower extremiy (LLE) to the right lower extremity (RLE) of male subjects. Greater trochanter to ischial tuberosity (GT-IT); apex of the sacral hiatus to ischial tuberosity (ASH-IT); apex of the sacral hiatus to medial border of sciatic nerve (ASH-Med SN); greater trochanter inferior line to lateral border of sciatic nerve (GTi- Lat SN); greater trochanter superior line to lateral border of sciatic nerve (GTs-Lat SN); ischial tuberosity to greater trochanter (IT-GT); ischial tuberosity to medial border of sciatic nerve (IT- Med SN); superior line width of the sciatic nerve (SW of SN); inferior line width of the sciatic nerve (IW of SN).

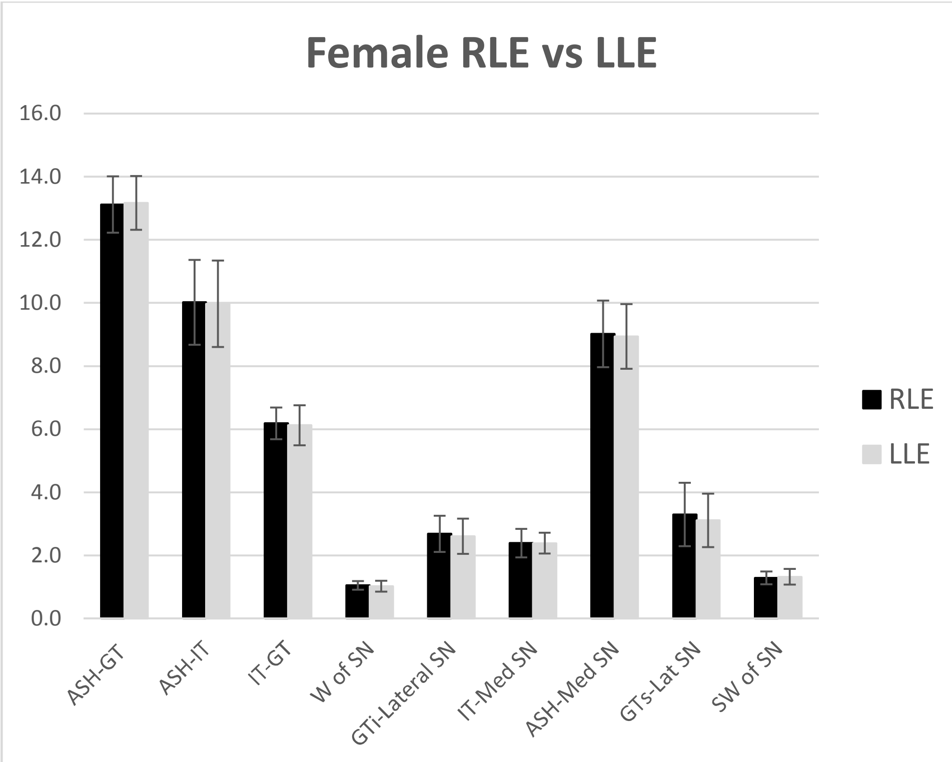


Figure 6. All data represented as means in centimeters (cm). Standard error bars represent SD. Paired t-tests were applied to compare the means of the left lower extremiy (LLE) to the right lower extremity (RLE) of male subjects. Greater trochanter to ischial tuberosity (GT-IT); apex of the sacral hiatus to ischial tuberosity (ASH-IT); apex of the sacral hiatus to medial border of sciatic nerve (ASH-Med SN); greater trochanter inferior line to lateral border of sciatic nerve (GTi- Lat SN); greater trochanter superior line to lateral border of sciatic nerve (GTs-Lat SN); ischial tuberosity to greater trochanter (IT-GT); ischial tuberosity to medial border of sciatic nerve (IT- Med SN); superior line width of the sciatic nerve (SW of SN); inferior line width of the sciatic nerve (IW of SN).