Zilaie, Mina., Anatomical Variation of the Inferior Mesenteric Vein's Drainage Pattern. Master of Science (Biomedical Sciences), May, 2015, 44 pp., 4 tables, 1 figure, bibliography, 48 titles.

The purpose of this project is to report the variable drainage pattern of the inferior mesenteric vein (IMV) as reported by medical students' observations recorded on anatomical variation data sheets (n = 192). A meta-analysis on the drainage pattern of the inferior mesenteric vein as described in various anatomy resources was conducted (n = 40). The inferior mesenteric vein was observed to drain into the splenic vein, the superior mesenteric vein, and the junction between the superior mesenteric vein and the splenic vein. Anatomy resources do not commonly report all three drainage sites. It is imperative that all these common drainage sites of the inferior mesenteric vein are stated in anatomy resources, so that students are taught realistic human anatomy including its common variations.

ANATOMICAL VARIATION OF

THE INFERIOR MESENTERIC

VEIN'S DRAINAGE PATTERN

Mina Zilaie, B.S.

APPROVED:

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ANATOMICAL VARIATION OF THE INFERIOR MESENTERIC VEIN'S DRAINAGE PATTERN

INTERNSHIP PRACTICUM REPORT

Presented to the Graduate Council of the

Graduate School of Biomedical Sciences

University of North Texas

Health Science Center at Fort Worth, Texas

In Partial Fulfillment of the Requirements

For the Degree of

MASTER OF SCIENCE

By

Mina Zilaie, B.S.

Fort Worth, Texas

May 2015

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Next, I would like to thank the Texas College of Osteopathic Medicine students who voluntarily chose to complete the anatomical variation data sheets. Their participation not only facilitated data collection but also was essential in the dissection of the cadavers.

Lastly, but most importantly, I would like to thank the generous body donors that I completely respect and value from the University of North Texas Health Science Center Willed Body program. Your precious gift to the anatomical sciences has provided us with great insight on human anatomy and science.

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CHAPTER I

INTRODUCTION

Anatomy resources consistently state that the inferior mesenteric vein (IMV) anatomically joins and drains into the splenic vein. However, the inferior mesenteric vein can also join and drain into the superior mesenteric vein or the junction between the splenic vein and the superior mesenteric vein *(13, 35-36, 39).* Variations of the venous drainage pattern of the inferior mesenteric vein into the splenic vein, superior mesenteric vein, or the junction between the splenic vein and the superior mesenteric vein were examined.

The hypothesis of this report was that the inferior mesenteric vein joins and drains equally into these three specific mesenteric venous sites. To test the hypothesis, information about the specific venous drainage pattern of the inferior mesenteric vein was determined from 85 data collection sheets regarding gastrointestinal vasculature variations. The data collection sheets were completed by first-year medical students at the Texas College of Osteopathic Medicine (TCOM) at the University of North Texas Health Science Center (UNTHSC) in Fort Worth, Texas from January 2013 to November 2014. The medical students at the University of Minnesota Medical School (U of M) also completed data collection sheets *(47)* that were combined with the anatomical variation data sheets from UNTHSC.

The variations in the inferior mesenteric vein's venous drainage pattern were recorded and reported based on these data collection sheets. In addition, a comprehensive meta-analysis on anatomy resources' discussion of the inferior mesenteric vein's drainage pattern was

conducted and tabulated. Whether anatomy textbooks accurately represent actual anatomical variation of the inferior mesenteric vein was evaluated. Chapter 2 presents the findings of this research project. Chapter 3 describes the internship experience in general.

CHAPTER II

PRACTICUM REPORT

Background and Literature Review

The venous drainage pattern of the inferior mesenteric vein is variable *(47).* Historically, anatomy textbooks state that the inferior mesenteric vein joins and drains into the splenic vein *(5, 7-9).* Furthermore, anatomy textbooks diagrammatically illustrate the inferior mesenteric vein joining and draining into the splenic vein *(6, 32, 37, 41).* According to recent literature, however, the inferior mesenteric vein has also been reported to join and drain into the superior mesenteric vein, the junction between the splenic vein and the superior mesenteric vein, or into other mesenteric venous drainage sites *(13, 35, 39, 47).* For example, an anatomy study based on 113 cadaveric observations by medical students at the University of Minnesota reported that the inferior mesenteric vein drained into the splenic vein in 36.3% of cases, the superior mesenteric vein in 41.6% of cases, and the junction between the superior mesenteric vein and the splenic vein in 21.2% of cases *(47).* Papavasiliou *et al.* reported that the inferior mesenteric vein drained into the splenic vein in 54% of cases, the superior mesenteric vein in 27% of cases, the confluence of the splenic vein and superior mesenteric vein in 17% of cases, the ileal branch in 0.3% of cases, and the jejunal branch in 0.67% of cases based on 300 consecutive computed topography (CT) scans *(35).* Another study interested in mesenteric anatomical variations in 54 patients undergoing helical CT venography of the pancreas found that the inferior mesenteric vein drained into the splenic vein in 56% of cases, the superior mesenteric vein in 26% of cases,

and the splenomesenteric angle in 18% of cases *(13)*. The inferior mesenteric vein joined the splenic vein in 68.5% of cases, the superior mesenteric vein in 18.5% of cases, and the splenoportal confluence in 7.6% of cases in a study that evaluated mesenteric venous patterns in 102 patients undergoing multidetector-row computed tomography (MDCT) before gastrointestinal or hepatobiliary-pancreatic surgery *(39)*. A case report noted that a 4-year-old girl who underwent abdominal surgery for extrahepatic portal hypertension, had an inferior mesenteric vein that drained directly into the superior mesenteric vein *(36)*. In light of this literature, it is evident that the inferior mesenteric vein's drainage can vary.

Many anatomy textbooks simply do not address the variability of the inferior mesenteric vein's drainage pattern into the various mesenteric venous drainage sites *(41-42)*. However, other anatomy textbooks may acknowledge this mesenteric vasculature variation and note that the inferior mesenteric vein can also join and drain into the superior mesenteric vein or into the junction between the splenic vein and superior mesenteric vein *(37, 40)*. Nonetheless, the majority of anatomy textbooks do not include pertinent statistical information like the frequency of the inferior mesenteric vein joining and draining into various mesenteric venous sites aside from the splenic vein, such as the superior mesenteric vein or the junction between splenic vein and superior mesenteric vein *(37, 40-42)*. Anatomy textbooks tend to either 1) not indicate any anatomical variation of the inferior mesenteric vein's venous drainage pattern, or 2) may indicate the common venous drainage sites of the inferior mesenteric vein. The frequency of the inferior mesenteric vein's drainage pattern into other mesenteric venous drainage sites besides the splenic vein is not usually reported. This can cause unnecessary confusion for students who reference these anatomy resources, especially when they attempt to apply the reading material to cadaver specimens. Understanding anatomical variations like the drainage pattern of the inferior

mesenteric vein is also applicable and important for aspiring gastrointestinal surgeons, who need to have comprehensive knowledge of the mesenteric region for successful surgeries. Therefore, it is imperative for anatomy resources to provide the various major drainage sites of the inferior mesenteric vein (the splenic vein, superior mesenteric vein, or the junction between the splenic vein and superior mesenteric vein) and also include the frequencies of this variability. This will provide a more accurate representation of this venous drainage pattern of the inferior mesenteric vein and an overall better understanding of anatomical variation in the mesenteric venous drainage system.

Specific Aims

The two-fold aim of this practicum report was: 1) to report the frequencies of the venous drainage of the inferior mesenteric vein into the splenic vein, the superior mesenteric vein, or the junction between the superior mesenteric vein and the splenic vein, and 2) motivate anatomy resources to indicate these common venous drainage sites of the inferior mesenteric vein and their associated frequencies. Therefore, the ultimate goal of this practicum report is to draw attention to the variable drainage pattern of the inferior mesenteric vein and make sure that students are taught about this common variation.

Significance

Common anatomical variations such as the inferior mesenteric vein's drainage pattern need to be included in anatomy textbooks to equip students with this knowledge in order to provide an accurate depiction of the human body. This will facilitate the student's learning process by making the application of textbook information to actual cadavers and/or patients easier, since students will be familiar with and expect certain anatomical variations. To help

achieve this goal, anatomy resources need to provide the specific, corresponding frequencies of the inferior mesenteric vein into the splenic vein, superior mesenteric vein, or the junction between the splenic vein and superior mesenteric vein in their text. In this way, anatomy students will be aware of the complexity of the mesenteric venous system and have an overall better understanding of human anatomy.

Hypotheses

Hypothesis 1

It is hypothesized that the inferior mesenteric vein will anatomically join and drain into the splenic vein, superior mesenteric vein, or the junction between the splenic vein and the superior mesenteric vein with equal frequency. In other words, the inferior mesenteric vein will anatomically join and drain equally often into the splenic vein (in 33% of cases), superior mesenteric vein (in 33% of cases), or the junction between the splenic vein and the superior mesenteric vein (in 33% of cases).

Hypothesis 2

It is hypothesized that the meta-analysis of anatomy resources will reveal that the majority of anatomy resources do not include the inferior mesenteric vein's variable drainage pattern into its common mesenteric venous drainage sites (the splenic vein, superior mesenteric vein, or the junction between the splenic vein and the superior mesenteric vein) or its associated frequencies of this variable mesenteric venous drainage pattern.

Research Design and Methodology

Anatomical Variation Data Collection Sheets

Information on the drainage pattern of the inferior mesenteric vein has been gathered with the use of data collection sheets regarding gastrointestinal vasculature variations from routine dissections done by medical students as part of their required human anatomy course. These data collection sheets (n = 85) have been completed voluntarily by first-year medical students at the Texas College of Osteopathic Medicine (TCOM) at the University of North Texas Health Science Center (UNTHSC) in Fort Worth, Texas from January 2013 to November 2014. Data collection sheets (n = 112) were also voluntarily completed by medical students at the University of Minnesota Medical School (U of M) from 2006 to 2011 and were provided by Dr. Anthony J. Weinhaus. The data collection sheets include a list of questions about various anatomical variations that were answered by the medical students based on observations of the anatomy of their lab group's cadaver. Each group was composed of four (U of M) or six (UNTHSC) medical students, who together completed one data collection sheet on a voluntary basis. Since the data sheet includes only questions about what is observable on the cadaver, this project does not qualify as research involving human subjects. This project focuses on the question related specifically to the inferior mesenteric vein's drainage pattern, though students also responded to questions about other variations (Appendix A).

The UNTHSC data sheet includes a multiple choice question (#4, see below) with the three major drainage sites of the inferior mesenteric vein but also contains an "other" option so that students were not restricted to one of the three major mesenteric venous drainage sites of the inferior mesenteric vein in cases where a less common variation was present.

4) Where does the inferior mesenteric vein drain?

a) splenic v.

b) superior mesenteric v.

c) junction between splenic and superior mesenteric veins

d) other (please specify below)

Meta-Analysis

A meta-analysis on various anatomy resources was conducted and tabulated. Anatomy resources including textbooks, dissectors, and atlases (n = 40) from the Gibson D. Lewis Health Science Library at UNTHSC were selected to be representative of commonly-used resources for anatomical education, without prior knowledge of their description of the inferior mesenteric vein's drainage pattern. These anatomy resources are available and accessible to all students at UNTHSC, who potentially reference them to learn anatomy. Many of the anatomy resources in the meta-analysis are popular books or reference materials in the curriculum of various undergraduate, graduate, and/or professional schools. A table has been organized to include the textual description of the inferior mesenteric vein's drainage pattern into the splenic vein, the superior mesenteric vein, or the junction between the superior mesenteric vein and the splenic vein. It is important to note that only anatomy resources with textual descriptions of the inferior mesenteric vein's drainage pattern were included. The tabulated meta-analysis serves to clearly consolidate all the information on the inferior mesenteric vein's drainage pattern that is reported by each anatomy resource.

Statistical Analyses

Hypotheses were tested using chi-square tests in SPSS *(21)*.

Results

University of North Texas Health Science Center Data

Based on the data from University of North Texas Health Science Center (UNTHSC), the inferior mesenteric vein drained into the splenic vein in 65% (55/85) of cases, the superior mesenteric vein 12% (10/85) of cases, the junction between the superior mesenteric vein and the splenic vein in 18% (15/85) of cases, and to another mesenteric site in 1% (5/85) of cases (Table 1). The drainage pattern of the inferior mesenteric vein into the splenic vein, the superior mesenteric vein, the junction between the superior mesenteric vein and the splenic vein, or any other mesenteric site is not equally distributed ($x^2 = 73.824$, df = 3, $p = 0$). The drainage pattern of the inferior mesenteric vein is still not equally distributed if we exclude the "other" category with its low frequency ($x^2 = 45.625$, df = 2, $p = 0$).

IMV Drainage Pattern Data from UNTHSC	
IMV Drainage Site	**Percentage of Cases**
Splenic vein	65 % (55/85)
Superior mesenteric vein	12 % (10/85)
Confluence	18 % (15/85)
Other	5 % (5/85)

Table 1. The frequency of the inferior mesenteric vein's drainage pattern in 85 cases from UNTHSC.

The frequency of the drainage pattern of the inferior mesenteric vein did not differ between the samples collected in the year 2013 versus the samples collected in the year 2014 (x^2 = 4.868, df = 3, p = 0.182).

University of Minnesota Data

Based on the data from the U of M (*47*), the inferior mesenteric vein drained into the splenic vein in 37 % (41/112) of cases, the superior mesenteric vein 42 % (47/112) of cases, and the junction between the superior mesenteric vein and the splenic vein in 21 % (24/112) of cases (Table 2). The drainage pattern of the inferior mesenteric vein into the splenic vein, the superior mesenteric vein, and the junction between the superior mesenteric vein and the splenic vein is not equally distributed, excluding the "other" category (x^2 = 8.4355, df = 2, p = 0.015).

IMV Drainage Pattern Data from U of M	
IMV Drainage Site	**Percentage of Cases**
Splenic vein	37 % (41/112)
Superior mesenteric vein	42 % (47/112)
Confluence	21 % (24/112)

Table 2. The frequency of the inferior mesenteric vein's drainage pattern in 112 cases from the U of M.

Combined Sample Data

The answer choices to option four varied between institutions ("other" vs. "hepatic portal vein") and, therefore, could not be compared. These options make up a small percentage of the instances and were therefore excluded from inter-institution comparison. Combining the data

from both institutions, the inferior mesenteric vein drained into the splenic vein in 50 % (96/192) of cases, the superior mesenteric vein 30 % (57/192) of cases, and the junction between the superior mesenteric vein and the splenic vein in 20 % (39/192) of cases (Table 3). The frequency of the drainage pattern of inferior mesenteric vein into the splenic vein, the superior mesenteric vein, and the junction between the superior mesenteric vein and the splenic vein differs between the two institutions ($x^2 = 23.454$, df = 2, $p = 0$).

IMV Drainage Pattern Combined Data from UNTHSC and U of M	
IMV Drainage Site	**Percentage of Cases**
Splenic vein	50 % (96/192)
Superior mesenteric vein	30 % (57/192)
Confluence	20 % (39/192)

Table 3. The frequency of the inferior mesenteric vein's drainage pattern in 192 cases from UNTHSC and the U of M combined.

Meta-Analysis Data

The information from the comprehensive meta-analysis based on anatomy resources (n = 40) including atlases, dissectors, and textbooks from the Gibson D. Lewis Health Science Library at the UNTHSC has been compiled and tabulated (Table 4). The anatomy resources' description of the drainage site of the inferior mesenteric vein into the splenic vein, superior mesenteric vein, or the junction between the splenic vein and the superior mesenteric vein was recorded and has been indicated in this meta-analysis.

The drainage pattern of the inferior mesenteric vein as reported by anatomy resources has been graphically represented (Figure 1). The inferior mesenteric vein is stated to drain into the

splenic vein in 68 % (27/40) of anatomy resources, the splenic vein and one other vein in 10 % (4/40) of anatomy resources, and all three mesenteric sites in 20 % (8/40) of anatomy resources. Only 2 % (1/40) of anatomy resources did not state that the inferior mesenteric vein drains into the splenic vein. None of the anatomy resources reported any of the frequencies related to the variable drainage sites of the inferior mesenteric vein.

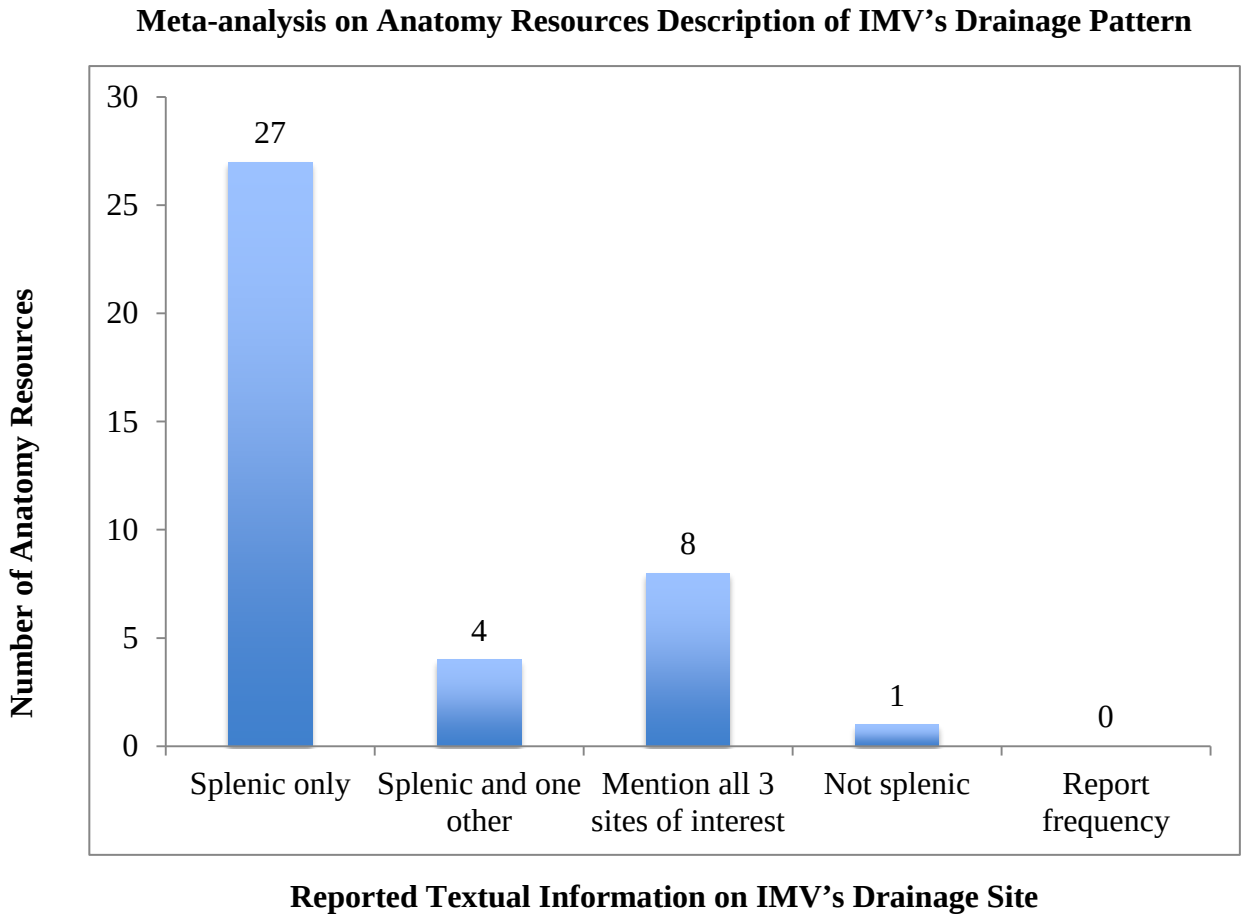

Figure 1. The drainage pattern of the inferior mesenteric vein (IMV) as reported in the textual information of anatomy resources (n = 40) from the Gibson D. Lewis Health Science Library at the UNTHSC.

IMV Drainage Site Mentioned in Anatomy Resource

Title of Anatomy Resource	Splenic Vein	Superior Mesenteric Vein	Confluence
Grant's Method of Anatomy: A Clinical Problem-Solving Approach (14)	Not mentioned	Not mentioned	X
Clinical Anatomy: Applied Anatomy for Students and Junior Doctors (8)	X	Not mentioned	Not mentioned
Anatomy at a Glance (9)	X	Not mentioned	Not mentioned
Gray's Anatomy, 15th Ed. (15)	X	Not mentioned	Not mentioned
Anatomy as a Basis for Clinical Medicine (20)	X	Not mentioned	Not mentioned
Hollinshead's Textbook of Anatomy (38)	X	Not mentioned	Not mentioned
Human Structure (23)	X	Not mentioned	Not mentioned
Oxford Textbook of Functional Anatomy (25)	X	Not mentioned	Not mentioned
Human Anatomy (26)	X	Not mentioned	Not mentioned
Clinical Anatomy for Medical Students (41)	X	Not mentioned	Not mentioned
Gross Anatomy Dissector A Companion for Atlas of Clinical Anatomy (42)	X	Not mentioned	Not mentioned
McMinn's Functional & Clinical Anatomy (27)	X	Not mentioned	Not mentioned
Clinically Oriented Anatomy (31)	X	Not mentioned	Not mentioned
Clinical Anatomy (43)	X	Not mentioned	Not mentioned
Clinical Anatomy By Regions (44)	X	Not mentioned	Not mentioned
Thompson's Core Textbook of Anatomy (2)	X	Not mentioned	Not mentioned
Anatomica's Body Atlas (3)	X	Not mentioned	Not mentioned
McMinn's Color Atlas of Human Anatomy (27)	X	Not mentioned	Not mentioned
McMurtrie's Human Anatomy Coloring Book (28)	X	Not mentioned	Not mentioned
Review of Gross Anatomy (34)	X	Not mentioned	Not mentioned
Essential Clinical Anatomy (30)	X	Not mentioned	Not mentioned
USMLE Step 1 Review, Anatomy: Ace The Boards Series (29)	X	Not mentioned	Not mentioned
Human Gross Anatomy: An Outline Text (24)	X	Not mentioned	Not mentioned

Title of Anatomy Resource	Splenic Vein	Superior Mesenteric Vein	Confluence
Anatomy (33)	X	Not mentioned	Not mentioned
Gray's Anatomy, 16th Ed. (16)	X	Not mentioned	X
Gray's Anatomy, 21st Ed. (17)	X	Not mentioned	X
Gray's Anatomy, 22nd Ed. (18)	X	Not mentioned	X
Gray's Anatomy, 24th Ed. (19)	X	Not mentioned	X
Gray's Anatomy for Students (7)	X	X	X
Blond's Anatomy (46)	X	X	X
Anatomy Development Function Clinical Correlations (22)	X	X	X
Grant's Dissector (40)	X	X	X
Textbook of Anatomy (37)	X	X	X
Essentials of Gross Anatomy (4)	X	X	X
Clinical Gross Anatomy: A Guide for Dissection Study and Review (5)	X	X	X
BRS Gross Anatomy (4)	X	X	X
Anatomy (48)	X	X	Not mentioned
Anatomy: Medcharts tables and summaries for review (10)	X	X	Not mentioned
Atlas of Human Anatomy with Integrated Text (11)	X	X	Not mentioned
Human Anatomy, Color Atlas and Textbook (12)	X	X	Not mentioned

Table 4. The comprehensive meta-analysis indicates the inferior mesenteric vein's drainage pattern as described in the textual information of 40 anatomy resources from the Gibson D. Lewis Health Science Library at the UNTHSC. "X" indicates that the specific drainage pattern of IMV was mentioned in the anatomy resource.

Discussion

Based on the data from UNTHSC, the inferior mesenteric vein drained into the splenic vein in approximately two-thirds of the cases. Therefore, the inferior mesenteric vein drained most frequently into the splenic vein compared to the superior mesenteric vein or the junction

between the superior mesenteric vein and the splenic vein. Contrary to the proposed hypothesis of the study, the inferior mesenteric vein did not drain equally into the three mesenteric sites. The "other" option, the fourth answer choice on the anatomical variation sheet, was suspected to be the reason for the unequal distribution of the drainage pattern of the inferior mesenteric vein due to its relatively small frequency (n = 5). However, the drainage pattern of the inferior mesenteric vein still was not equally distributed between the splenic vein, the superior mesenteric vein, and the junction between the superior mesenteric vein and the splenic vein. Nevertheless, it is still important to note that the inferior mesenteric vein did drain into the junction between the superior mesenteric vein and the splenic vein or the superior mesenteric vein in one-third of the cases.

Based on the data from the University of Minnesota, the inferior mesenteric vein drained more often into the superior mesenteric vein than into the splenic vein or the junction between the superior mesenteric vein and the splenic vein. It is important to note, however, that the inferior mesenteric vein drained into the splenic vein or the junction between the superior mesenteric vein and the splenic vein in approximately 60% of cases. The inferior mesenteric vein did not drain with equal frequency into the splenic vein, superior mesenteric vein, or the junction between the superior mesenteric vein and the splenic vein. The "hepatic portal vein" answer choice was eliminated due to the possible effects of its low frequency on the distribution of the inferior mesenteric vein drainage pattern, but the distribution remained unequal. Despite the unequal distribution of the inferior mesenteric vein's drainage into these three mesenteric sites, it is important to recognize its variable drainage pattern into the splenic vein, the superior mesenteric vein, or the junction between the superior mesenteric vein and the splenic vein.

It is particularly interesting that the inferior mesenteric vein drained most often into the splenic vein based on the data from UNTHSC, but drained most often into the superior mesenteric vein based on the data from the University of Minnesota. This highlights possible regional differences in the drainage pattern of the inferior mesenteric vein given that the frequency of drainage pattern differed between the two institutions.

Combining the data from both institutions (ignoring possible regional variations in favor of a larger and possibly more generally representative sample) reveals that the inferior mesenteric vein drained most often into the splenic vein in 50 % of the cases, but also drained into the superior mesenteric vein or the junction between the superior mesenteric vein and the splenic vein in the remaining 50 % of cases. The combined data from the two institutions was not distributed equally into the between the splenic vein, the superior mesenteric vein, and the junction between the superior mesenteric vein and the splenic vein.

The meta-analysis reveals that the overwhelming majority of anatomy resources indicate that the inferior mesenteric vein drains into the splenic vein. In fact, all but one anatomy resource indicated that the inferior mesenteric vein drains into the splenic vein. However, only eight of all the listed anatomy resources indicated that the inferior mesenteric vein drains into the splenic vein, the superior mesenteric vein, or the junction between the superior mesenteric vein and the splenic vein. Only 12 anatomy resources indicated that the inferior mesenteric vein can drain into the superior mesenteric vein, and only 13 anatomy resources indicated that the inferior mesenteric vein could drain into the junction between the superior mesenteric vein and the splenic vein. Anatomy textbooks likely state that the inferior mesenteric vein drains into the splenic vein, because that is the drainage site of the inferior mesenteric vein that is “most” often seen in human anatomy This, however, begs for a definition of what is considered “most” often.

Whether “most” should be considered 60% versus 90% of cases, or some other frequency, is entirely subjective.

It is therefore important to evaluate why anatomy textbooks consistently state that the inferior mesenteric vein drains into the splenic vein when in fact it is also seen to drain into the superior mesenteric vein and the junction between the superior mesenteric vein and the splenic vein in half of all cases.

In our combined sample, the inferior mesenteric vein drained most often into the splenic vein in 50 % of the cases, and drained into the junction between the superior mesenteric vein and the splenic vein in the remaining 50 % of cases (n = 192). It does not seem accurate to claim that the “most” frequent drainage site of the inferior mesenteric vein is the splenic vein, since that is what is observed in only half of all cases and gives little indication concerning common variations in drainage pattern. Anatomy textbooks indicate the inferior mesenteric vein drains into the splenic vein, but this is not sufficient information that provides an accurate representation of the inferior mesenteric vein’s actual variable drainage pattern.

Based on our results from both institutions combined, we ran additional statistics on the observed drainage pattern of the inferior mesenteric vein into the splenic vein (50 % of cases) versus the expected drainage pattern of the inferior mesenteric vein into the splenic vein based on varying percentages (60 %, 90 %, and 100 % of cases). The inferior mesenteric vein drained into the splenic vein in 50 % (96/192) of the observed cases, which is not significantly different than the inferior mesenteric vein hypothetically draining into the splenic vein in 60 % (115.2/192) of the cases ($x^2 = 3.2$, df = 1, $p = 0.073638$). It is significantly different than the inferior mesenteric vein hypothetically draining into the splenic vein in 90 % (172.8/192) of the cases ($x^2 = 34.1$, df = 1, $p < 0.00001$). It is also significantly different than the inferior

mesenteric vein hypothetically draining into the splenic vein in 100 % (192/192) of the cases (x^2 = 48, df = 1, $p < 0.00001$).

If “most” cases is defined as 60% of cases, this report provides support that the inferior mesenteric vein drains to the splenic vein in most instances. If, however, “most” implies a higher frequency, such as 90%, this report finds insufficient evidence to support that claim.

The meta-analysis indicates that anatomy resources almost always describe the inferior mesenteric vein draining into the splenic vein, but do not tend to note its variable drainage pattern into the superior mesenteric vein or the junction between the superior mesenteric vein and the splenic vein. Based on the results from the experimental study, it is clear that the inferior mesenteric vein does drain into all three of these sites. Anatomy resources could be made more useful by more accurately reflecting anatomical variation such as the anatomical variation represented by the inferior mesenteric vein.

Conclusions

The conclusion of this study is that the inferior mesenteric vein does indeed drain into three mesenteric sites: the splenic vein, the superior mesenteric vein, or the junction between the superior mesenteric vein and the splenic vein. It is imperative for anatomy textbooks to recognize this variable drainage pattern of the inferior mesenteric vein and its associated frequencies, so that students are informed and aware of mesenteric anatomical variations that are commonly present.

Based on results of the study, we cannot make the claim that the inferior mesenteric vein drained equally into the splenic vein, the superior mesenteric vein, and the junction between the

superior mesenteric vein and the splenic vein, thus refuting our initial hypothesis. This project nevertheless yields two results of interest: 1) while the majority of textbooks state that the inferior mesenteric vein drains into the splenic vein in the majority of cases, this is likely to be an oversimplification of anatomical reality that has the potential to confuse students, and 2) evidence for possible regional variation in drainage pattern of the inferior mesenteric vein.

Limitations

Limitations of this proposed study emerge from the nature of data collection in this study. Relying on medical students for the data collection introduces the potential for inter-observer error. This is, however, a common method of data collection for anatomical variations. Error should be reduced with a well-designed data collection tool. Data collection sheets were excluded from the study if the students left them blank or did not seem to understand the question.

CHAPTER III

INTERNSHIP EXPERIENCE

Description of Internship Site and Experience

My internship site was located at the Human Anatomy Lab in the Integrated Physiology and Anatomy Department at UNTHSC in Fort Worth, TX. Generous body donors from Willed Body Program at UNTHSC provide students like me with a unique educational opportunity to study anatomy. The professors in the anatomy department warmly welcomed me in lab and strengthened my understanding of basic human anatomy.

On a daily basis, I interacted and learned from Dr. Claire A. Kirchhoff, Dr. Rehana Lovely, Dr. Rustin E. Reeves, Dr. Armando Rosales, and Dr. Geoffrey Guttmann. With their constant support and assistance, I was able to pilot the first master's in anatomy program at UNTHSC this year. I helped advance UNTHSC's anatomy curriculum by producing and editing anatomy film learning modules that students can utilize as supplemental learning material to better understand anatomy. This experience familiarized me with basic video editing and editing software such as Adobe Premiere Pro as well as improved my personal understanding of anatomy. As part of the new anatomy master's program, I had the opportunity to take a neuroscience class with the first-year TCOM students. This experience directly exposed me to demanding medical school coursework, which honed my study and time management skills. In addition, I took a research seminar class and participated in journal club, which significantly improved my ability to critically think and analyze scientific literature. The Socratic method

style of journal club encouraged the exchange of different ideas, so I was exposed to different perspectives and thoughts about various research topics. These classes kept me up-to-date with current scientific research and advancements, particularly in the field of anatomy.

For my internship, I was an anatomy lab teaching assistant who taught and helped the Master's in Medical Sciences students understand basic human anatomy in their cadaver-based human anatomy course from January 16, 2015 to April 10, 2015. Dr. Rehana Lovely organized and informed me of my specific responsibilities as a teaching assistant for each lab. I reviewed the anatomy material accordingly and was prepared to teach students. The anatomy course was divided into different sections of the human body, so I was able to focus on each section of the human body and learn the details of human anatomy. I am very thankful for my opportunity at this internship that truly strengthened my understanding of overall human anatomy.

Journal Summary

For my internship, I was an anatomy lab teaching assistant in the Human Anatomy Lab at UNTHSC that assisted the Master's in Medical Sciences students in their anatomy lab course from January 16, 2015 to April 10, 2015. My major responsibilities were to teach basic human anatomy, answer and explain concepts to students, and maintain the anatomy lab. This experience as a teaching assistant provided me with a major leadership role, increased my confidence, and deepened my knowledge of human anatomy.

APPENDICES

APPENDIX A: EXAMPLE UNTHSC ANATOMICAL DATA COLLECTION SHEET

(Complete sheet inserted on following pages. Original data sheet is a single-sided page; version presented here is reformatted to match the rest of the practicum report document).

Anatomical Variation Data Collection Sheet
Tank number:
Sex of donor:

GI

1. How would you describe the degree to which your dissection was complete as you begin filling out this data collection sheet?
   a) Completely done
   b) Mostly done
   c) Not sure
   d) Intended to use data sheet to help me decide
   e) Other, please describe:

2. Which of the following best describes the celiac trunk you observe?
   a) Splenic, common hepatic, and left gastric arteries branch from the celiac trunk.
   b) The 3 arteries are individual branches directly from abdominal aorta
   c) Only 2 of the 3 usual arteries branch from the celiac trunk. Indicate which artery does not arise from the celiac trunk and where it does branch from:
   d) A fourth artery branches from the celiac trunk. Indicate the name of this artery based on the organ it supplies:

3. Where does the cystic artery branch from?
   a) Left hepatic a.
   b) Right hepatic a.
   c) Common hepatic a.
   d) Proper hepatic a.
   e) Gastroduodenal a.
   f) Gallbladder removed
   g) Other (please specify below)

4. Where does the inferior mesenteric vein drain?
   a) Splenic v.
   b) Superior mesenteric v.
   c) Junction between splenic and superior mesenteric veins
   d) Other (please specify below)

5. Where does the right gastric artery branch from?
   a) Left hepatic a.
   b) Right hepatic a.
   c) Common hepatic a.
   d) Proper hepatic a.
   e) Gastroduodenal a.
   f) Other (please specify below)

6. Where does the middle colic artery branch from?
   a) Superior mesenteric a.
   b) Inferior mesenteric a.
   c) Other (please specify below)

7. Where does the left colic artery branch from?
   a) Superior mesenteric a.
   b) Inferior mesenteric a.
   c) It is absent
   d) Other (please specify below)

8. How many sigmoidal artery branches do you observe?

9. Was it necessary to perform any additional dissection to answer the variation questions?
   a) Yes
   b) No
   c) Other, please describe:

APPENDIX B

DAILY JOURNAL

January 16, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Make and Take Quiz on Brachial Plexus (Tag structures, explain/answer the students' questions, lab setup, and cleanup).

January 20, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the parts of the brachial plexus (Tag structures, explain/answer the students' questions, lab setup, and cleanup).

January 26, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Review the structures of the back, including the triangular space, triangular interval, and quadrangular space, and their contents (explain/answer to students' questions, lab setup, and cleanup).

January 30, 2015, 7:45 a. m. to 10:00 a. m.

Medical Science anatomy lab teaching assistant: Setup Medical Science Lab Exam 1 (tag structures).

February 4, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Make and Take Quiz on anterior thigh and femoral triangle (explain/answer to students' questions, lab setup, and cleanup).

February 6, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the bones of the ankle and foot. Make and Take Quiz on Posterior Leg. Identify the features of the femur, tibia, and fibula, and describe their functions (explain/answer to students' questions, lab setup, and cleanup).

February 10, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the features of the pelvis, femur, tibia, and fibula, and describe their functions (explain/answer to students' questions, lab setup, and cleanup).

February 16, 2015, 8:00 a. m. to 10:00 a. m.

Medical Science anatomy lab teaching assistant: Setup Medical Science Lab Exam 2 (tag structures).

February 17, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Contrast the features of the left vs. right lungs; Identify the structures at the hilum (explain/answer to students' questions, lab setup, and cleanup).

February 20, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Make and Take Quiz on Lungs (explain/answer to students' questions, lab setup, and cleanup).

February 25, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Describe the blood supply and venous drainage of the heart (explain/answer to students' questions, lab setup, and cleanup).

February 27, 2015, 8:00 a. m. to 10:00 a. m.

Medical Science anatomy lab teaching assistant: Setup Medical Science Lab Exam 3 (tag structures).

March 9, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the branches from the celiac trunk (explain/answer to students' questions, lab setup, and cleanup).

March 10, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the lobes and features of the isolated liver (explain/answer to students' questions, lab setup, and cleanup).

March 13, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the branches from the celiac trunk (explain/answer to students' questions, lab setup, and cleanup).

March 17, 2015, 8:00 a. m. to 10:00 a. m.; 11:45 a. m. to 1:00 p. m.

Medical Science anatomy lab teaching assistant: Setup Medical Science Lab and proctor Exam 4 (tag structures).

March 20, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the branches of the internal iliac artery (explain/answer to students' questions, lab setup, and cleanup).

March 24, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the branches of the internal iliac artery (explain/answer to students' questions, lab setup, and cleanup).

March 30, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teacher assistant: Identify structures of the kidney and posterior abdominal wall and describe their functions (explain/answer to students' questions, lab setup, and cleanup).

March 31, 2015, 12:00 p. m. to 5:00 p. m.

Medical Science anatomy lab teaching assistant: Identify the branches of the internal iliac artery (explain/answer to students' questions, lab setup, and cleanup).

April 6, 2015, 11:30 p. m. to 1:30 p. m.

Medical Science anatomy lab teaching assistant: (lab setup, assist with quiz station).

April 10, 2015, 8:00 a. m. to 10:00 a. m.; 11:45 a. m. to 1:00 p. m.

Medical Science anatomy lab teaching assistant: Setup Medical Science Lab and proctor Exam 5 (tag structures).

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