The Development of a Teaching Resource Manual for Novice Registered Nurses: Cannulation of Arteriovenous Fistulas

by © Yvonne Keats

A practicum report submitted to the School of Graduate Studies in partial fulfillment of the requirements for the degree of

Master of Nursing

School of Nursing

Memorial University of Newfoundland

August, 2016

Abstract

Background: Patients with End Stage Renal Disease (ESRD) will require lifesaving hemodialysis treatments. As a result, patients will need a vascular access such as, an arteriovenous fistula (AVF) for the successful delivery of these treatments. Therefore, it is crucial for novice nurses to acquire the skill acquisition needed to cannulate this complex access. ***Purpose:*** The purpose of this practicum project was to develop a teaching resource manual designed for novice registered nurses in relation to cannulation of the AVF. The teaching resource manual can be utilized for cannulation skill acquisition during orientation to assist in increasing overall knowledge while also enhancing patient outcomes. ***Methods:*** An integrated literature review and consultations with key stakeholders were conducted to gather pertinent information on the novice nurse and cannulation of the AVF. ***Results***: Based on the results of the consultations and integrative literature review, a manual was created using the theoretical frameworks of Morrison's Instructional Design Model (2004), Benner's Novice to Expert Model (1984) and Knowles Adult Learning Theory (1984). The manual was divided into chapters covering anatomy of the kidney, AVF cannulation skills and techniques, assessment and nursing interventions. ***Conclusion***: The teaching resource manual was not implemented due to time constraints. A plan for next steps pertaining to the manual is discussed in the final report. The manual will need to be evaluated to determine if learning and skill acquisition was increased by novice registered nurses through the use of the teaching resource manual.

Key words: cannulation, hemodialysis, vascular access, novice nurse and orientation.

Acknowledgements

Professor Mary Bursey, Practicum Supervisor: Thank-You for expanding my knowledge and enhancing my writing skills. Your knowledge and expertise has guided my project and made me a stronger student. This practicum project has been a great learning experience that will enhance my nursing practice for the future.

Staff and Colleagues at the Waterford Hospital and Health Science Centre: Thank-You for devoting your time and expertise in assisting me with developing this manual. Your support and guidance has moulded this project.

Mom and Dad: Your love and support has allowed me to compete this journey in my academics. As always your words of encouragement and support is what has made me the hard working person I am today. I hope to be as good a parent to my own children as you have been to me. Words cannot express how grateful I am to have had parents like the two of you.

Chris, my Husband: The support, love, encouragement and positive energy you have surrounded me with has allowed me to come to the end of this journey. Words cannot express how eternally grateful I am that you are my husband. As I finish this portion of my academic career I have you to thank for carrying me to the finish line.

Brooke and Addison, my girls: The two best accomplishments in my life, please know that hard work and dedication will open any door that you can dream of for your future. Its been a very busy and long journey but I hope someday I will support my beautiful girls in fulfilling their dreams. Dream big Princesses.

Table of Contents

The Development of a Teaching Resource Manual for Novice Registered Nurses on Cannulation of Arteriovenous Fistulas

Novice registered nurses that are just starting their careers have the added challenge of learning many different skills and tasks at one time, but when placed in a specialty area such as, dialysis, proficiency in needling techniques is vital to treatment. Nurses entering into clinical settings where they assume professional responsibilities that are beyond their capabilities can be problematic for both nurse and patient (Dyess & Sherman, 2009). It is paramount to ensure that nurses are appropriately trained and mentored regarding the correct way to care for AVFs to increase longevity and survival (Schoch & Smith, 2012). The hemodialysis orientation at the Waterford Hospital does not include a specific orientation manual targeted at skill acquisition of cannulating an AVF. The development of this manual was to ensure that novice registered nurses get consistent and knowledge rich training that will enhance their skills and increase the longevity of the AVF and patient outcomes. Improper cannulation techniques can result in damage to the AVF and will impact the treatment of the patients. For the delivery of a hemodialysis treatment vascular access is an important requirement. It is considered the lifeline for patients on hemodialysis and has a huge impact on clinical and patient outcomes (Mbamalu & Whiteman, 2014). The AVF is considered the first choice of access for patients, this is supported by clinical guidelines in Canada (CANNT, 2015).

Background

In Canada the number of people that are diagnosed with kidney disease has tripled in the last two decades. At the end of 2009, there were approximately 22, 310 people needing hemodialysis (Public Health Agency of Canada, 2013). Hemodialysis is a life extending treatment that is offered to patients with end stage kidney disease (ESRD) (Canadian Institute for Health Information, 2011). The province of Newfoundland and Labrador has the highest rate in Canada of newly diagnosed patients over the age of 65 years with ESRD. This medical distinction has transformed the type of patients requiring hemodialysis in our province and is compounded by an increased number of older patients with more co-morbidities being offered dialysis (Barrett, Butler, Bornstein, Doyle, & Gilliam, 2008). Kidney disease is a serious chronic disease that poses a challenge not only to those living with the disease, but also to their families, communities and the health care system (Public Health Agency of Canada, 2013). In 2014, there were 5,269 new dialysis patients, 77% of these patients were receiving hemodialysis (Canadian Organ Replacement Register, 2016). As a result, patients receiving dialysis treatments will require a vascular access such as an AVF for the successful delivery of the hemodialysis treatment.

The AVF is now accepted as the most optimal vascular access for patients requiring hemodialysis because of its longevity and low incidence of morbidity and mortality. Due to the fact that AVFs are the access of choice for patients in the dialysis setting it is vital that novice nurses have the proper cannulation skills and resources that are required to needle this complex access site. Improper cannulation techniques can

result in damage to the AVF and will impact the treatment of the patients. Access-related complications are associated with low blood flow rates and extended treatment times, resulting in inadequate dialysis treatments, and increased morbidity and mortality (See et al., 2014).

Rationale

This practicum project was chosen based on the need of novice registered nurses to have a teaching resource manual targeted at AVF cannulation. In 2010, I was hired as a novice registered nurse to the hemodialysis unit at the Waterford Hospital. I have worked in this specialty area for over four years and have gone through the orientation process. I found the task of AVF cannulation very difficult and anxiety inducing. Building a relationship with patients as a new nurse can also enhance this anxiety and fear surrounding the cannulation process. The current orientation at the Waterford Hospital focuses on various skills and techniques required to work in the specialty area of hemodialysis. I felt there was a need for an additional resource focused on AVF cannulation that novice nurses could utilize to increase their skill acquisition and knowledge.

Practicum Project

Resource

Through an informal needs assessment and discussions with key stakeholders it was discovered that there was a need for a teaching resource manual targeted at AVF

cannulation. The development of this manual can be utilized for cannulation skill acquisition for novice registered nurses and assist in increasing overall knowledge while also enhancing patient outcomes. The manual is designed to assist novice registered nurses with cannulation of AVFs and act as an additional resource for nurses in the hemodialysis units.

Contact Person

Throughout the development of this project the Clinical Educator and Vascular Access Nurse were utilized as agency contacts. Both nurses were very supportive and forthcoming with any resources and contacts that could be utilized to improve and enhance the development of the manual. Both nurses were kept up to date and informed of the progress of the manual's development. The Regional Manager of the Dialysis Program Linda Ivany was contacted in person. Approval was granted in writing to conduct this project as well as to meet with the nursing staff to obtain information related to orientation and cannulations of patients' AVFs.

Ethics Approval

The Health Research Ethics Authority (HREA) screening tool was utilized to determine if this practicum project needed approval from the Research Ethics Board. The screening tool checklist was performed and it was found that ethical approval was not needed, as it is not a research project (see Appendix B).

Practicum Goals and Objectives

The overall goal of my practicum project was to provide novice registered nurses with

a teaching resource manual that would provide education on cannulation techniques of AVFs for patients during orientation to the Dialysis Program. This manual was also designed to provide consistent and concise education to ensure that registered nurses with varying areas of experience receive a consistent and knowledge rich resource that can be utilized for orientation and also throughout the dialysis unit. At the start of this practicum project several objectives were outlined to guide the trajectory of the project. The main objectives of this practicum project are outlined below:

1. To gain knowledge pertaining to the effectiveness of a resource manual for cannulation of AVFs for individuals receiving hemodialysis in a thorough integrative literature review.
2. To gather information utilizing an environmental scan regarding cannulation of AVF's during orientation of registered nurses employed in other Dialysis Programs in Canada.
3. To gain insight and knowledge from a target group of novice registered nurses in which this manual will be utilized in their clinical practice.
4. To complete consultations with the Clinical Educator and Vascular Access Nurse in the Eastern Health Authority Regional Dialysis Program at the Waterford Hospital and Health Sciences Centre in St. John's Newfoundland.
5. To develop a teaching resource manual for novice registered nurses on cannulation of AVF based on the information gathered from the integrative literature review and consultations with key stakeholders.
6. To conduct a formal presentation of the developed practicum project.

7. To apply Knowles Theory of Adult Learning (1980), Benner's Novice to Expert Model (2004) and Morrison's Instructional Design (1982) in the development of this practicum project.

8. To demonstrate advanced nursing practice competencies utilized throughout the duration of the practicum course.

Overview of Methods

For the development of this teaching resource manual two main methods were utilized to investigate if a manual targeted for novice registered nurses on AVF cannulation was warranted. First, an integrated literature review was conducted to gather pertinent information regarding the needs of novice nurses and the importance of cannulating an AVF accurately for patients. The theoretical framework provides the underpinning for the development of the manual. Knowles Theory of Adult Learning (1980), Benner's Novice to Expert Model (2004) and Morrison's Instructional Mode (1982) were used in the development of this practicum project and provided a foundation from which this manual was created. A detailed description of these frameworks can be found in Appendix A of the literature review.

Secondly, consultations were conducted with novice registered nurses, an expert cannulator, Clinical Nurse Educator, Vascular Access Nurse at the Waterford Hospital and Health Sciences Centre in St. John's, NL. The Nurse Practitioner in Nephrology at London Health Sciences Centre, London Ontario was contacted and interviewed via email on several occasions. The purpose of completing consultations with key stakeholders in relation to AVF cannulation was to gain information and perspective on

skill acquisition. For the complete Consultation Report see Appendix B of this final report. Based on the results obtained from these methods the teaching resource manual was developed. The developed resource manual can be found in Appendix C of this final report.

Summary of Literature Review

Search Methods

For the integrative literature review, various online databases were utilized such as CINAHL and PubMed. I also conducted a general search using Google to gather articles of interest pertaining to my topic. The major search terms that were used for this literature review but not limited to included: novice nurse, novice to expert nurse, perceptual novice, hemodialysis orientation, arteriovenous fistula, vascular access cannulation, skill acquisition. Both qualitative and quantitative studies were found with key studies pertinent to the evidence needed to support the manual that was developed.

The integrated literature review was conducted to examine the need for a teaching resource manual on AVF cannulation skill acquisition for novice registered nurses. Several themes emerged from the literature review such as, skill acquisition for novice registered nurses, expectations of the novice nurse, and the importance of targeted orientation programs for novice registered nurses. Below are some of the key findings that were revealed in the integrative literature review.

Skill Acquisition for Novice Registered Nurses

The literature review found that nurses have to be competent with the correct procedure of cannulation of AVFs. In order to achieve this competency, orientation has to be consistent and concise to ensure proper skill acquisition is obtained (Parisotto et al., 2014; Schoch & Smith, 2012). The literature also highlighted that failure to cannulate effectively was due to limited learning opportunities and lack of orientation surrounding cannulation skills which led to feelings of failure by the nurses (Finkman & Salantera, 2014; Wilson, Harwood, & Oudshoorn, 2013). Many of the studies highlighted the importance of the nurse being proficient at needling a fistula and lack of education and orientation impacts acquiring this skill. The need for consistent ongoing education for new nurses was viewed equally as important as the orientation process (Harwood, Wilson, & Oudshoorn, 2016; Rush, Adamack, Gordon, Janke, & Ghement, 2015; Schoch & Smith, 2012). The literature also reinforced the importance of orientation programs in increasing staff confidence and enhancing competency and knowledge. Orientation programs targeted at specialized areas created an increase in confidence, competency, retention, and skills in practicing nurses (Bonner & Greenwood, 2006; Park & Jones, 2010). Therefore, a teaching resource manual utilized in the orientation period for novice nurses would assist in increasing knowledge and skill acquisition (Finkman & Salantera, 2014).

Novice Registered Nurse Expectations

The literature review identified several studies that focused on lack of support, improper orientation and decreased mentoring in clinical practice that impacted the novice nurse's ability to thrive in a specialty area (Dellasega, Gabbay, Durdock, & Martinez-King, 2009; Finkman, & Salantera, 2014; Wilson, Harwood, & Oudshoorn, 2013). The overall findings from the studies clearly indicated that novice nurses need to be properly prepared for their nursing positions. In addition, hospitals need to have programs to educate and train staff to ensure that appropriate knowledge and skills are implemented for novice nurses to succeed in their roles. Orientation was viewed as a vital aspect of imparting knowledge and expectations to novice nurses to help them have a successful transition from nurse to specialty area (Chandler, 2012). The literature highlighted the need for novice nurses to understand the expectations of the clinical area. Lack of knowledge surrounding expectations can cause feelings of frustration, abandonment and fear of negative patient outcomes in the nurses (Chandler, 2012; Finkman, & Salantera, 2014). Nursing education given in the orientation setting that is theory driven and lacks the workplace expectations can also hinder the success of new nurses.

Importance of Targeted Orientation Programs

Multiple studies from the literature identified the AVF as the safest access choice for patients in the dialysis setting (Mbamalu & Whiteman, 2014; See, Shugart, Lamb, Kallen, Patel, & Sinkowitz-Cochran, 2014; Van Loon, Kessel, Van Der Sande, & Tordoir, 2009). Ensuring nurses have access to targeted orientation programs and

resources that are required to needle this complex access was seen as vital in the literature (Wilson, Harwood, & Oudshoorn, 2013). The literature highlighted the importance of orientation programs in reducing AVF complications from improper cannulation such as hematoma, aneurysm formation, infection, and missed cannulation requiring multiple needle sticks (Moist, Trpeski, Na, & Lok, 2008; Van Loon, Kessel, Van Der Sande, & Tordoir, 2009). The results from the literature review also demonstrated that a need exists for a consistent psychomotor competency for AVF cannulation in the clinical setting. The evidence suggests that nurses working in specialty areas such as, hemodialysis need be properly trained and orientated in the care of this type of access, in order to achieve optimal patient outcomes (Pile, 2004; Schoch & Smith, 2012.).

Summary of Consultations

The consultations were vital in the development of this practicum project. Consultations with key stakeholders confirmed the themes found in the literature review and supported that this project would be beneficial for novice registered nurses entering the specialty area of hemodialysis. Consultations were conducted with novice registered nurses, an expert cannulator, Clinical Nurse Educator, Vascular Access Nurse, and a Nurse Practitioner in Nephrology. These key stakeholders provided valuable information regarding specific AVF cannulation needs and perspective was gained on skill acquisition for nurses. The consultations with the key stakeholders took place at either the Waterford Hospital or Health Sciences Centre in St. John's, Newfoundland and Labrador (NL). The consultations were informal and consisted of a set of interview questions that were approved by my Supervisor Professor Mary Bursey. All interviews were 15-20 minutes

in length and conducted in a conference room at both sites. Some of the consultations with key stakeholders occurred via email or telephone.

The target population of four novice registered nurses were consulted and interviewed as a group to gather pertinent information related to the development of a teaching resource manual. The teaching manual would be utilized by this group and information was gained regarding what topics should be included in the manual to ensure that learning occurred and skill acquisition was reached by the novice nurses. The Expert Cannulator had valuable information on improving novice nurses performance with cannulating AVFs independently and accurately. The Vascular Access Nurse had expertise and knowledge with AVF cannulation. The knowledge received from this consultation helped guide and direct the development of this teaching manual. Through consultations with her I received valuable information to include in the manual to maintain longevity of the AVF by increasing skill set through assessment and troubleshooting. The Clinical Educator in Hemodialysis was another consultation vital to the project. Her responsibilities as an educator played an integral role in the orientation and education of novice nurses in the dialysis program. Her perspective was vital for the development of this teaching manual as she has vast knowledge with the current orientation and skills nurses are lacking in their clinical practice. Another consultation was with Dr. Lori Harwood, a Nurse Practitioner in Nephrology at the London Health Sciences Centre, London, Ontario. Her expertise and knowledge with increasing novice nurse skill set and moving beyond the "perpetual novice" was vital to the development of this teaching resource manual. Her opinion was valuable as she has extensive experience

studying this area. She also participates in the orientation process of nurses in the Hemodialysis Program.

Consultation Results

The data derived from the consultations were vital to the development of the practicum project. The results obtained from the consultations with key stakeholders contributed to several implications in the development of this teaching resource manual pertaining to AVF cannulation. The consultations were essential in determining if a project of this nature was warranted and beneficial for novice registered nurses entering the specialty area of hemodialysis. The results obtained from the consultations strengthened the information that was learned through the integrated literature review with several common themes emerging from the consultations.

The novice nurses interviewed all described feelings of fear and anxiety surrounding the process of AVF cannulation. The nurses indicated that lack of confidence and skill contributed to this anxiety. The participants reported that lack of skill with AVF cannulation contributed to feelings of apprehension surrounding the process of cannulation. The need for increased development in assessment and troubleshooting skills prior to cannulation of patients was seen as vital to skill acquisition. Increased exposure to cannulation experiences was expressed as an important aspect of enhancing cannulation skill. The novice nurses also stated a manual specifically dedicated to AVF cannulation would be useful for knowledge and skill development. The nurses also emphasized the need for a manual specific to AVF cannulation as an additional resource during the orientation period. The nurses stated that a teaching resource manual targeted

at cannulation would provide the learner with consistent information allowing all nurses to receive the same information and skill exposure.

Consultations indicated that a teaching resource manual would be valuable as a guide and provide assistance with AVF cannulation. It was suggested that a manual of this nature could provide a strong foundation for new nurses prior to practicing cannulation by increasing comfort level and reducing anxiety. Assessment was emphasized as an important aspect to be included in the manual to understand areas of an AVF that need to be avoided, in order to maintain fistula longevity and maintain patient outcomes. Importance of understanding policies and procedures was also another area that the participants felt needed to be included in the manual. All key informants stated it would be beneficial to highlight the importance of policies and procedures for AVF cannulation. All these consultations supported the need for a teaching resource manual targeted at AVF cannulation for the novice registered nurse.

Overview of Resource Manual

Purpose

The development of this teaching resource manual was to help with AVF cannulation skill acquisition for novice registered nurses and assist in increasing overall knowledge while also enhancing patient outcomes. This resource manual will provide consistent and concise education to novice registered nurses with varying areas of experience. This resource can be used in addition to orientation and also throughout the dialysis unit as a supplementary learning resource.

The manual was divided into seven chapters and consist of the following topics:

- Chapter One: The Kidneys
- Chapter Two: Vascular Access
- Chapter Three: AVF
- Chapter Four: Needle Placement and Size
- Chapter Five: Cannulation
- Chapter Six: Educational Interventions
- Chapter Seven: Additional Resources

Resource Manual Content

The first chapter of this manual is designed to review the anatomy and physiology of the kidneys. It focuses on various types of kidney disease such as, CKD, ESRD, and the complications that result. Hemodialysis is discussed as a lifesaving treatment offered to patients with a video link provided for nurses to see the process.

The second chapter describes various types of vascular access such as, the AVF, CVC, and AVG. Each type of vascular accesses is discussed with some facts given on AVF and why this is the optimal choice for access selection for patients.

The third chapter of the manual addresses the anatomy of the AVF in the upper arm and the first choices surgeons' utilize when creating fistulas. A definition of cannulation is discussed and a diagram provided for nurses to match the skill of the

cannulator with the AVF to ease patient comfort and decrease complications while increasing nurse success**.**

Chapter four explores the importance of needle placement for nurses to ensure the AVF is not damaged during cannulation. Clinical guidelines are discussed in relation to needle gauge to ensure the longevity and integrity of AVF is maintained at all times. Illustrations are provided to help the nurse visualize needles and proper placement.

Chapter five of the resource manual takes the learner through the process of cannulation using a step approach . The first part of this chapter is designed to provide the nurse with effective assessment skills needed to properly assess a fistula. The next part of this section takes the nurse through a step by step process of cannulation. The learner starts at skin preparation for the patient and then progresses into tourniquet use. The process of cannulation from needle insertion to removal is detailed and illustrations are provided to depict each step.

Chapter six was created to provide the nurse with some educational interventions in terms of AVF cannulation. The first part of this sections informs the nurse about various complications that can occur with the AVF and how to assess and recognize when these occur. The next section provides the nurse with various interventions that occur during the cannulation process and what should be done in the event any should occur to the patient. Finally, the nurse is provided with some educational interventions to provide to the patient to assist in maintaining the longevity of the AVF.

The final section of this resource manual provides the nurse with some additional resources that can assist in enhancing cannulation skill and also provide knowledge and proper guidelines. This section can also be used for professional and patient based information that can be obtained from the list of resources.

Implementation and Evaluation

Implementation

This teaching resource manual was not implemented or evaluated due to time constraints in meeting the partial requirements for the degree. However, following the completion of this degree, the manual should be presented to the Regional Director of the Dialysis Program, a target group of novice registered nurses, Clinical Educator and Vascular Access Nurse at the Waterford Hospital in St. John's, NL. The plan of implementation is that the agency will approve the manual developed and utilize it as an adjunct to the current orientation program for novice registered nurses. It would also be beneficial if an electronic copy of this manual could be used as an additional online resource to other nurses seeking information on cannulation of the AVF.

Evaluation

Once implementation of the manual is completed, then the next step is to have it evaluated to determine whether novice nurses' knowledge related to cannulation of AVFs increased as a result. The evaluation will highlight the effectiveness of the information in changing nursing practice. The evaluation of the manual will include written feedback

from the novice nurses that use the manual in orientation. This can be provided in the form of a short questionnaire to ask what was effective or what changes could improve the manual. Based on the feedback received appropriate changes would be made. Finally, an audit of AVF cannulation for patients would indicate if AVF cannulation was successful for novice nurses.

Advanced Nursing Practice Competencies

This practicum project has allowed me to demonstrate several of the Advanced Nursing Practice competencies that are outlined by the Canadian Nurses Association (2008). The competencies that have been addressed throughout this practicum include research, leadership and consultation. For the research competencies, I have identified and implemented research-based innovations for improving client care, organizations and systems (CNA 2008). I conducted an integrated literature review of several research studies pertaining to the proposed topic and analyzed their effectiveness. In developing this teaching manual I have generated, synthesized and analyzed research pertinent data . I have utilized evidence-based practice that will enhance patient outcome and nursing psychomotor competencies. I also gathered information on the current orientation program that is in place at the Waterford Hospital by comparing it to relevant research that was obtained in a literature review.

I have demonstrated the competency of leadership by identifying the learning needs of nurses and other members of the health care team and finding or developing programs and resources to meet those needs (CNA, 2008). I achieved this objective by developing a teaching resource manual that targeted the direct learning needs of novice

nurses in terms of cannulation of AVFs and creating a manual based on these needs. This practicum allowed me to create a manual that is consistent and concise for other nurses in terms of educational needs to enhance skills and promote care for patients.

The advanced competency of consultation was utilized in the development of this teaching resource manual to use evidence-based practice and the expertise of staff to guide the trajectory of the project. Consultation is a competency that was evident throughout the entire development of this manual. Effective communication with patients and the inter-professional team are vital components in nursing practice. The ability to consult with colleagues across sectors and at the organizational, provincial, national and international level is a characteristic of nurses in advanced practice (CNA 2008). I continuously met with important healthcare members such as, clinical educators and a vascular access nurse. During this practicum I initiated timely and appropriate consultation as needed to enhance the success of the practicum.

Conclusion

This final report has summarized the main objectives that were outlined in the beginning of this practicum. The integrative literature review was completed followed by ongoing consultations with key stakeholders. During the development of this manual the advanced practice competencies were evident throughout the entire creation and development process of the teaching resource manual. The goal for this practicum was achieved and a teaching resource manual for cannulation of AVFs was created utilizing the literature and consultations.

Novice registered nurses striving to succeed in a specialty area such as, dialysis, have reported feelings of incompetence, anxiety and fear surrounding cannulation of the AVF. The teaching resource manual was created based on the need for a resource that was targeted at AVF cannulation during the orientation phase. In this final report the background, rationale, objectives and goal of the project were discussed. The project methods and the integrated literature review summary and consultations with key stakeholders were also discussed. The teaching resource manual was created using a theoretical framework which created the foundation for the entire manual. The process of implementation and evaluation were addressed, as well as a breakdown of each chapter of the resource manual. The integrated literature review, consultation report and teaching resource manual are included in Appendices A, B, and C of this final report.

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Appendices

Appendix A

Integrative Literature Review: Importance of a Teaching Resource Manual for Novice Registered Nurses on Cannulation of Arteriovenous Fistulas

Yvonne Keats

Memorial University

An integrated literature review was completed with the focus of exploring the impact trained cannulation techniques have on the life of an arteriovenous fistula (AVF) and the direct consequences this technique has for dialysis patients. According to The Kidney Foundation of Canada (2016), 1 out of 10 Canadians will develop kidney disease. This will lead to the need for treatment modalities such as hemodialysis. Vascular access is considered a fundamental prerequisite and lifeline for patients receiving hemodialysis and will impact both clinical and patient outcomes (Mbamalu & Whiteman, 2014). The AVF has been accepted as the optimal access for dialysis treatments and cannulation acquisition is essential for nurses and failure to perform this procedure properly can result in complications to the patient (Wilson, Harwood, & Oudshoorm, 2013).

The development of a teaching resource manual can be utilized for cannulation skill acquisition for novice registered nurses and assist in increasing overall knowledge while also enhancing patient outcomes. In order to demonstrate the benefits of this resource a through literature review was conducted for current evidence. The purpose of developing this teaching resource manual is to ensure that novice registered nurses get consistent training that will improve skill acquisition. Enhancing new nurse's cannulation skills will increase the longevity of the AVF and increase patient outcomes. Improper needling of an AVF can have negative impacts on the quality of treatment and patient health. In order to articulate that such a manual is warranted, the learning needs required for novice registered nurses in specialty areas was also examined, as well as the overall usefulness of a learning resource manual as an instructional tool. Morrison's Instructional Design Model (2004), Benner's Novice to Expert Model (1984) and

Knowles Adult Learning Theory (1984) are also explored in relation to the development of the teaching resource manual.

Integrated Literature Review

For this literature review, I utilized various online databases such as CINAHL and PubMed. I also conducted a general search using Google to gather articles of interest pertaining to my topic. The major search terms that were used for this literature review but not limited to include: novice nurse, novice to expert nurse, perceptual novice, hemodialysis orientation, arteriovenous fistula, vascular access cannulation, skill acquisition. A variety of articles were obtained and consisted of both qualitative and quantitative studies. I have assembled several literature summary tables of various research articles that are of interest to the proposed topic (see Appendix A).

Background and Topic Relevance

In Canada, the number of people that are diagnosed with kidney disease has tripled in the last two decades. Kidney disease is a serious chronic disease that poses a challenge not only to those living with the disease but also to their families, communities and the health care system (Public Health Agency of Canada, 2013). At the end of 2009, there were approximately 22,310 people needing hemodialysis (Public Health Agency of Canada, 2013). Hemodialysis is a life extending treatment that is offered to patients with end stage kidney disease (ESRD) (Canadian Institute for Health Information, 2011). The province of Newfoundland and Labrador has the highest rate in Canada of newly diagnosed patients over the age of 65 years with ESRD. This has transformed the kind

patients requiring hemodialysis in our province. This is further compounded by an increased number of older patients with more co-morbidities being offered dialysis (Barrett, Butler, Bornstein, Doyle, & Gilliam, 2008). In January 2008, there were 380 patients on dialysis in this province; 65% of these patients were being treated by hemodialysis in main hospital-based dialysis units in St. John's, Corner Brook, and Grand Falls-Windsor (Barrett et al., 2008). As a result, patients with ESRD require a vascular access such as an AVF for the successful delivery of the hemodialysis treatment.

Vascular access is the most essential requirement for the delivery of hemodialysis among patients with ESRD. It is considered the lifeline for patients on hemodialysis and has a huge impact on clinical and patient outcomes (Mbamalu & Whiteman, 2014). The AVF is considered first choice of treatment for patients. Clinical guidelines in Canada recommend the AVF as the ideal choice for access type in hemodialysis patients (Wilson, Harwood, & Oudshoorn 2013). In a multiple observational study conducted in seven countries (France, Germany, Italy, Japan, Spain, the United Kingdom, and the United States) of patients receiving hemodialysis in agencies, Young et al. (2000) found that mortality rates increased with the use of internal jugular catheters and arteriovenous grafts as opposed to using the AVF as a method of treatment. There was a 32% increased risk of death in patients using an intrajugular catheter for hemodialysis and a 15% increased chance in those with arteriovenous grafts compared to an AVF. The AVF is a more desirable choice for access compared to the central venous catheter (CVC).,The main reasons are the following: decreased risk of bloodstream infections, low hospitalization rates, and better survival rate (See, Shugart, Lamb, Kallen, Patel, &

Sinkowitz-Cochran, 2014). Patients receiving hemodialysis are at an increased risk of bloodstream infections due to the need for repeated access of the bloodstream and the risk for developing invasive infections is greater than that of the general population (Arora et al., 2013; Kallen, Arduino, & Patel 2010). Given these findings, the AVF is considered the most optimal vascular access choice for patients requiring hemodialysis because of its longevity and low incidence of morbidity and mortality (Santoro et al., 2014; Van Loon, Kessel, Van Der Sande, &, Tordoir, 2009).

Current research shows that the AVF is the safest access choice for patients in the dialysis setting. It then becomes crucial that front line nurses have the proper cannulation skills and resources that are required to needle such a complex access for patients. Numerous complications can arise from improper cannulation of an AVF for example, hematoma, aneurysm formation, infection, and missed cannulation requiring multiple needling of the patient's AVF(Van Loon, Kessel, Van Der Sande, & Tordoir, 2009; Wilson et al, 2013). In a study by Moist, Trpeski, Na, and Lok (2008), changes in practice patterns in dialysis facilities were seen as a complication to the AVF longevity in patients indicating there is a need for a consistent procedural methodology in the clinical setting. This is evidence that nurses working in specialty areas such as hemodialysis must be properly trained and orientated in the care of this type of access in order to achieve optimal patient outcomes (Pile, 2004). Improper cannulation techniques can result in damage to the AV fistula and will impact the treatment of the patients. Access-related complications are associated with low blood flow rates leading to extended treatment times resulting in increased morbidity and mortality (See et al., 2014).

Novice Registered Nurse Expectations

Novice registered nurses that are striving to succeed in a specialty area have described feelings of incompetence, difficulty in organizing, prioritizing, and delegating tasks (Chandler, 2012). This learning is further exacerbated when these same nurses are placed in a specialty area e.g. dialysis where proficiency in various techniques is vital to patient treatment. In a study by Finkman and Salantera (2014), data were collected from interviews with 15 new nursing graduates in relation to reasons why they left their position within the first year of practice. Several themes emerged from this study with participants indicating lack of support, improper orientation and decreased mentoring in clinical practice. These participants also stated that the orientation program they received was inadequate and did not support the skills required for the position. As a result, these nurses reported feelings of frustration, abandonment and fear of negative patient outcomes. Nursing education that was given in the orientation setting was theory driven and lacked the practical challenges of the workplace. The findings of this study highlight the need for hospitals to utilize programs to educate and train staff so that appropriate knowledge and skills are implemented to enhance success.

Researchers Wilson, Harwood and Oudshoorn (2013) conducted an ethnographic study interviewing nine hemodialysis nurses to examine the link between personal, environmental and contextual factors that hindered skill acquisition. The skill acquisition of cannulation was examined and the failure to perform this skill successfully, resulted in negative patient outcomes. Participants of the study indicated that failure to cannulate successfully was due to limited learning opportunities and orientation. In comparison to

Finkman and Salantera (2014), nurses interviewed indicated that lack of orientation surrounding cannulation skills also led to feelings of failure. The participants revealed that the orientation received was inadequate which enhanced feeling of uncertainty, abandonment and fear of mistakes. Having an adequate orientation was indicated as a way to facilitate a positive transition for the novice nurse.

In an earlier study by Wilson, Harwood, Oudshroon and Thompson (2010), the reported cannulation experiences of hemodialysis nurses were examined with particular focus on nurse practice patterns. The results from this study showed that the nurses verbalized a need for a standard orientation on cannulation procedures and a follow-up be completed to assist with the identification of any additional learning needs. The nurses also reported that ongoing education on AVF cannulation would be vital to skill acquisition and to enable them to progress from novice to expert in this clinical competency.

Daily journaling and focus groups were utilized in a qualitative study conducted by Dellasega, Gabbay, Durdock and Martinez-King (2009). Three experienced nurses were observed for a six-month orientation period to gather information pertaining to the orientation needs of experienced nurses compared to novice nurses. The experiences of the nurses varied from four to 20 years nursing experience. The results showed that experienced nurses that are hired into a new clinical area also need to have an orientation program that includes ongoing dialogue about the expectations of the new role and any reported anxieties that are present. The study highlighted that orientation programs need to provide the nurse with opportunities to draw on past experiences to acquire new skill

acquisition. This is important when developing a teaching resource manual, since the target population is novice registered nurses entering the specialty of dialysis. The manual should build on the previous knowledge, skills and clinical practice experiences of the registered nurses.

Skill Acquisition for Novice Nurses

Novice registered nurses that are being hired into specialty areas have to assume professional responsibilities that are beyond their capabilities, which can be problematic for both nurse and patient (Dyess & Sherman, 2009). This type of atmosphere requires the nurse to make clinical judgments about patient care and be accountable for positive patient outcomes (Wilson et al., 2013). Nurses in the dialysis unit often rely on the guidance of experienced nurses for direction and knowledge (Dennison, 2011). Therefore it is of paramount importance that nurses are appropriately trained and mentored in relation to best practices to provide care for AVFs to increase longevity of its survival and maintain positive patient outcomes (Schoch & Smith, 2012).

Nurses have to be competent with the correct procedure of cannulation, especially with newly created fistulas. Cannulation of the AVF is essential in a hemodialysis treatment. A chronic hemodialysis patient needs at least 312 needle insertions per year (Van Loon, Kessel, Van Der Sande, & Tordoir, 2009). Cannulation practice is mainly based on theory, practical guidelines and experience (Parisotto et al., 2014). A factor that impacts a nurse's ability to be proficient at needling a fistula is lack of education and orientation. Due to the fact that needing a fistula is so imperative, the need for consistent

ongoing education for new nurses is equally as important as the orientation to dialysis unit (Schoch & Smith, 2012.).

Although there are resources available to novice nurses for cannulating fistulas, it is often times overwhelming. In-depth information without practical explanation can be intimidating to nurses that are new to the procedure of cannulation (Parisotto et al., 2014)). Policies and procedures are available for nurses as a guide, but it cannot teach and inform a novice nurse of the basics of cannulation. Nursing educators are increasingly challenged to find adequate clinical experiences to prepare novice nurses for these practical demands. Limited exposure to patients and different preceptor techniques directly impacts the opportunities for experiences with certain types of cannulating situations (Rhodes & Curran, 2005).

In a recent Canadian qualitative study Harwood, Wilson, and Oudshoorn (2016) utilized appreciative inquiry to determine what attributes contribute to successful AVF cannulation. Eighteen nurses were interviewed from three-hemodialysis units using semi-structured interviews. Content analysis showed that opportunity and skill development are vital to nurses to transition from novice to expert. The nurses reported that having the opportunity to practice the skill of cannulation is important to skill acquisition, as well as reduces reported feelings of anxiousness and increases confidence. Nurses agreed that the orientation period is crucial to the development of skill acquisition. Exposure to cannulation on a continuous basis in the orientation period provides basic skills needed to successfully and safely cannulate an AVF for patients. Another important theme was the importance of staff support in assisting novice nurses with cannulation. Repeated

exposure of cannulation of AVFs from an expert nurse or vascular access nurse contributes to successful cannulation.

Educating and preparing novice nurses has become increasingly more challenging in the acute clinical environment (Rush, Adamack, Gordon, Janke, & Ghement, 2015). It is therefore of upmost importance that hospitals provide novice nurses with effective work environments that foster education. One strategy that hospitals can use to help in novice nurses' preparation is establishing effective orientation programs (Bowles, & Candela, 2005). Following a review of several orientation programs, Park and Jones (2010) found that orientation programs are effective in increasing staff confidence and enhancing competency and knowledge. The review also showed that orientation programs targeted at specialized areas created an increase in confidence, competency, retention and skills in practicing nurses. In a grounded theory study by Bonner and Greenwood (2006), six non-expert and 11 expert nurses were interviewed regarding nursing expertise and how it was acquired and the difference in practice between an expert and a novice nurse. Themes that were observed from this study pertained to how skill is influenced by education and knowledge. Nurses verbalized that the task of cannulation was a focus. However, even when the needle was placed successfully in a patient they lacked the skills and knowledge to troubleshoot any issues with the AVF for the patient. Some other themes identified the issue of orientation to dialysis and how stressful it was perceived with less emphasis on cannulation techniques.

Theoretical Framework

The application of Morrison's Instructional Design Model (2004), Benner's Novice to Expert Model (1992) and Knowles Theory of Adult Learning (1984) were utilized in the development of the teaching resource manual, in order to specifically tailor to the needs of the novice registered nurses working in the Dialysis Program. The theoretical framework provided a foundation in which the manual was created and below is a description of how each theory was utilized throughout development:

Morrison's Instructional Design Model

The teaching resource manual was developed utilizing Morrison, Ross, and Kemp's Instructional Design Model (2004). This model focuses on the learner rather than that of the instructor and facilitates learning that is targeted at specific learning needs. There are three main stages involved in this model such as planning, implementation and evaluation.

The planning stage of this model will be examined to outline how this model will direct the trajectory of the resource manual. The planning stage includes instructional problem, learner characteristics, task analysis, and instructional objectives. The instructional problem based on my four years of clinical expertise in the hemodialysis unit is the lack of orientation of AVF cannulation for novice registered nurses that are orientating to the hemodialysis units.

The second stage of the planning stage includes learner characteristics. This stage examines specific characteristics of the target population (Morrison et al., 2004). The

target population of this program will be novice registered nurses. These nurses would lack the experience required for AVF cannulation in a specialty area such as hemodialysis.

The task analysis stage of this model is considered a vital aspect of the planning phase. This stage allows the educator to determine the knowledge and procedures that need to be inclusive in a teaching resource manual to ensure the inclusion of the proper criteria (Morrison et al., 2004). Consultations with novice and expert nurses and other key stakeholders will assist in the development of the resource manual to ensure that the teaching is inclusive for the group utilizing it.

The last stage of the planning model is the instructional objectives. This will specifically outline the exact objectives that will need to be mastered by the novice registered nurses (Morrison et al., 2004). These objectives will allow the novice nurse to gather the knowledge and skill acquisition needed to maintain positive patient outcomes and AVF longevity.

Benner's Novice to Expert Model

Nursing practice is faced with many complex and diverse patient needs that require the nurse to be proficient as well as transitioning from novice to expert to have a positive impact on patient health (Dyess & Sherman, 2009). In developing this teaching resource manual, Benner's Novice to Expert Model (1982) will be utilized to develop an orientation program that will enhance skill acquisition in a specialty area such as hemodialysis. Benner (1982) identifies five levels of competency for nurses: novice,

advanced beginner, competent, proficient, and expert.

The novice nurse is at the beginner's stage of the model and has little or no experience. The nurse at this stage has a paucity of knowledge and clinical experience and is striving to enhance skill acquisition (Benner, 1982). The literature indicates that many novice nurses feel unprepared for the clinical setting. Reasons include the increase in required prerequisite nursing skills and knowledge which places further responsibilities on the novice nurse in terms of acquiring these skills amongst experienced nurses (Maguire, 2013; McCalla-Graham & De-Genge, 2015). Orientation programs are successful when they include the knowledge and skills that can transition a novice nurse to an expert nurse (Park & Jones, 2010). This will allow the nurse to grow and demonstrate the ability to cope and deal with issues pertaining to cannulation of AVF for patients..

In the advanced beginners phase, the learner has an increased efficacy in specialty skills. The learner is able to perform independently with minimal prompts. The learner is still continuing to develop a knowledge base at this point. The nurse would then progress to the competent level. A nurse who has been on the job for two or three years typically acquires this level of competency. It is in this level that the nurse is more efficient and is able to establish goals and plans (Benner, 1982). With continued practice the competent nurse is able to transition to the proficient stage. Experience in this level is what prepares the nurse to deal with specific events and to modify plans as a result of these events (Benner, 1982). The final level is that of the Expert. The expert nurse has a concrete

grasp on the skills and knowledge required and has the keen ability to accurately assess each situation (Benner).

Knowles Adult Learning Theory

For the development of this teaching resource manual I will utilize Knowles Adult Learning Theory (1984) to achieve the desired outcomes. Knowles (1984) developed a learning model that encompassed the needs of the learner. He suggested that adults learn differently than children. This theory gives recognition to the fact that learning is autonomous and self-directed. It indicates that adult learners are responsible for being independent decision makers and attain knowledge and skills more effectively when there is collaboration with various nursing expertise rather than bombarding them with information sessions (Mitchell & Courtney, 2005). Integrating various methods of teaching allows the learner to be engaged and interested in a topic and to relate to the learning experience by drawing on their own experiences.

Knowles Learning Theory (1984) emphasizes that adult learners are practical and have a need to learn things that are relevant to them. Learners need to feel that the information being taught is relevant and will guide and enhance their nursing practice. The AVF resource manual will start from the ground up to build on the nurses' knowledge, in order that the final outcome reflects an in-depth knowledge base to assist with the application of practical skills.. It is imperative that staff are appropriately trained and mentored regarding the knowledge and skills of cannulation to ensure the longevity of AVF survival (Schoch & Smith, 2012).

Another concept derived from Knowles Theory of Learning (1984) is that adult learners also learn independently (Knowles). Students are encouraged to become more involved and self-directed in the learning process. Self-directed learning is more about enhancing critical thinking skills than being content based. The learner takes control of their education and learns what they view as important (Fisher, King, & Tague, 2001). The novice nurses in the dialysis unit would be motivated to utilize this teaching resource manual in an effort to increase their knowledge base and skill acquisition.

Another concept of Knowles Adult Learning Theory (1984) is that adults learn best in an environment that values prior learning experiences of the nurse. In order to effectively create this manual, prior working experience has to be respected and built upon. It is crucial that the nurses being orientated have the chance to discuss prior learning and experiences. Some of these nurses will be nurses experienced in various clinical areas, but are novice to dialysis. Their opinion in relation to further learning and to enhance knowledge would be essential in the creation of the teaching resource guide. Also the newly graduated nurse would be able to offer suggestions in relation to the content in the resource manual.

Conclusion

An integrated literature review was conducted to examine the need for a teaching resource manual on AVF cannulation skill acquisition for novice registered nurses. In completing this review, vascular access was examined and the AVF is identified in the literature as the ideal means of vascular access compared to other options. Several studies showed the importance of educating nurses on proper cannulation skills to maintain the

longevity of this type of access. The literature review also supports that orientation programs targeted at specific educational needs can increase skill acquisition and knowledge base for novice nurses. The application of Morrison's Instructional Design Model (2004), Benner's Novice to Expert Model (1992) and Knowles, Adult Learning Theory (1984) were discussed in terms of applicability to developing a teaching resource manual, in order to specifically tailor to the needs of the novice registered nurses working in the Dialysis Program. An integrated review of the literature supports the importance of a teaching resource manual specific to novice nurses on AV cannulation.

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Appendix A

Name, Author, Date, Study, Objective	Sample/Group (size, setting, characteristics	Design and Methodology	Key Results/Findings	Strengths/limitations	Conclusions
Cannulation practice patterns in hemodialysis vascular access: Predictors for unsuccessful cannulation Van Loon, Kessels, Van Der Sande, Tordoir, (2009) An observational study the incidence of mis-cannulations and related complications were observed. Patient characteristics,	158 chronic hemodialysis patients were utilized for the sample For this research study, data was collected by dialysis nurses, using identical case record forms and a standardized method was used to register data from each dialysis session. The case reference form for this study consisted of 16 points :	This prospective, observational study of newly created AVFs and AVGs, evaluated the complications caused by cannulation, and the clinical consequences of failed cannulation Differences in cannulation practice variables for AVF and AVG were tested with the chi-square test. Difference in the duration of CVC use was tested	During the study period, 37% of patients with arteriovenous fistulae (AVF), and 19% of patients with arteriovenous grafts (AVG) had more than 10 miscannulations. Cannulation-induced hematoma resulted into single-needle (SN) and catheter dialysis in 40% of the patients. The use of central venous catheters (CVC) and SN dialysis were significant predictors of VA failure ($p < 0.0001$).	The study protocol was approved by the Medical Ethical Committee of the Maastricht University Medical Centre Large sample size of 158 chronic hemodialysis patients Unintended faults by healthcare may not have been recorded which could have impacted the results There is a need to improve cannulation practice and to con-duct more studies regarding this topic in the future.	This study is relevant to clinical nursing practice and improving patient outcomes. It educates nurses on venous access such as fistulas and how to maintain there longevity

comorbidities and venous access characteristics like type of venous access were correlated with occurrence of cannulation-related complications. In addition, the cannulation technique and practice patterns like needle direction; tourniquet use and years of experience of dialysis nurses were registered.	• Inspection for hematoma caused by cannulation • redness • Swelling • auscultation using the stethoscope • type of needle used • needle direction and position • cannulation technique • number of necessary cannulations • ease of cannulation • tourniquet use • years of experience of the dialysis nurse	with the Mann–Whitney test For each of these variables, a univariate Cox regression analysis was performed. To determine independent risk factors, all univariate significant variables (entry p value = 0.05) were included in a step- wise forward multivariate Cox regression analysis.	Patency of the AVF depends on a variety of factors. In addition to quality of blood vessels and surgical success the way the fistula is needled and cared for by staff affects patency		

Name, Author, Date, Study, Objective	Sample/Group (size, setting, characteristics	Design and Methodology	Key Results/Findings	Strengths/limitations	Conclusions
The acquisition and exercise of nephrology nursing expertise: a grounded theory study Bonner, & Greenwood (2006) The purpose of this study was to describe the process of expertise acquisition in nephrology nursing practice Qualitative study	Sample included 6 non-expert and 11 expert nurses in nephrology The study took place in one rental unit in South West Whales, Australia The unit had acute and chronic renal services, transplant, home hemodialysis training and peritoneal training	Grounded theory methodology Data collection for this study involved participant observation, informal open-ended interviews and analysis of documentation 103 hours of participant observation 24 hours of interviews 10 episodes of documentation of nurses collected The data collection and analysis used process of substantive and theoretical coding	Three core categories came out of this study: Non-expert Experienced expert Expert Some of the themes that were observed from this study: Skill is influenced by education and knowledge Nurses verbalized that the task of cannulation was a focus but even when the needle was placed successfully they lacked the skills and knowledge to troubleshoot any issues with the fistula Some other themes that came from the study that some	<u>Strengths</u> Ethics approval was obtained by the Area health Service and University Human Ethics Committee The study provided insight into cannulation from the novice nurse and there has been a gap in the literature pertaining to this topic <u>Limitations</u> Small sample size was used Only used one hemodialysis Centre so it was not generalizable to other units	The unique finding came from the study and this included ensuring the nurse has knowledge, experience, skill, and focus to obtain skill acquisition needed for cannulation

			nurses interviewed found the orientation to dialysis stressful with less emphasis on cannulation Cannulation played a secondary role and limited opportunity's were available		

Name, Author, Date, Study, Objective	Sample/Group (size, setting, characteristics	Design and Methodology	Key Results/Findings	Strengths/limitations	Conclusions
An exploratory study of the orientation needs of experienced nurses Dellasega, Gabbay, Durdock, & Martinez-King (2009) The purpose of this study was to examine the difference in orientation needs of experienced nurses as compared to novice nurses	A qualitative study was used with daily journaling and focus groups Sample size was three experienced nurses Participants were monitored for a six month orientation period Work history of the nurses varied All nurses had to consent to journal daily and participate in the focus groups Evaluation for there adjustment in a new position	Qualitative study using two intensive methodologies such as journaling and focus groups They had to record any thoughts or feelings pertaining to the orientation process and specific needs of support At the end of month three a focus group was held to evaluate the experience of the new position and orientation Focus groups were recorded and then transcribed and then coded by each of the	Three themes emerged from the study: Assessing expectations, realistic appraisal and acceptance It emerged form these themes that it may be beneficial to include things in orientation such as communication and conflict resolution Needs to include ongoing dialogue about anxiety in the new role and ability to draw on past experiences to learn new skills Nurses transitioning to a new area will benefit from discussing various	<u>Strengths</u> Small sample size of an elite group <u>Limitations</u> The small sample size may have contributed to therapeutic benefit and bias Hard to generalize to the population	This study offers insight that can shape recruitment and retention of nurses Orientation is not the same and needs to be tailored for each specialty area

		nurses, facilitator and supervisor Inerratic process was used to analyze the data	issues during the orientation phase Nurses experienced anxiety in this study in their ability to perform in a new role		

Name, Author, Date, Study, Objective	Sample/Group(size, setting, characteristics	Design and Methodology	Key Results/Findings	Strengths/limitations	Conclusions
Early career experiences and perceptions-a qualitative exploration of the turnover of young registered nurses and intention to leave the nursing profession in Finland Flinkman, & Salantera, (2015) The purpose of this study was to examine why new nurses left an organization	Sample size of 15 nurses Ages ranged from 24-29 years of age and all female The nurses that participated were recruited from Finland from one hospital district and one public health Centre	Qualitative study In-depth descriptive approach Semi-structured interviews were used with open ended questions All were conducted outside the workplace by telephone or Skype Interviews were 17-61 minutes in duration Transcribed verbatim for coding and analysis using the software ATLAS	Three themes emerged from this qualitative study: Poor practice environment, lack of support orientation, and mentoring and nursing as a second best career choice For the second theme, which focused on orientation, the nurse's interviews revealed that they did not receive an adequate orientation as new graduates. This resulted in feelings of uncertainty and feeling unprepared for skill acquisition	<u>Strengths</u> <u>Limitations</u> Small sample size Longitudinal or prospective approach may have yielded more significant findings Nurses knew the topic was about turnover and this may have swayed the attitudes and interviews of the nurses	This type of study could be done again with a larger sample size to yield results that could change retention and orientation practices for new nurses

Name, Author, Date, Study, Objective	Sample/Group (size, setting, characteristics	Design and Methodology	Key Results/Findings	Strengths/limitations	Conclusions
Hemodialysis vascular access: How do practice patterns affect outcome Pile (2004) Peer reviewed article This peer reviewed article explores data on trends in vascular access outcomes form the Dialysis Outcomes and Practice Patterns Study (DOPPS) Examines how this data correlates with the recommendations of the National Kidney Foundations kidneys Disease Outcomes Quality Initiative	The peer review used a case study to illustrate several of the concepts derived from the DOPPS study	Uses a case study to illustrate how Nephrology nurses can help to improve vascular access outcomes The DOPPS is a international prospective longitudinal observational study of dialysis practices Done using 12 countries	Several themes emerged from the review of the study such as vascular access survival, Access choices, timing of the cannulation, medications and patency, and staff practices The DOPPS findings lead to the need for more education, protocols, procedures and orientation The study revealed that there is a need for mentoring staff members who care for vascular access as it impacts patient outcomes	This was a peer reviewed study that analyzed the finding of another study (DOPPS) Vascular access choice differed in the U.S., Europe and Asia which can be attributed to patient mix	Evidence from these studies could modify practice patterns

Name, Author, Date, Study, Objective	Sample/Group (size, setting, characteristics	Design and Methodology	Key Results/Findings	Strengths/limitations	Conclusions
The lived experience of new graduate nurses working in an acute care setting McCalla-Grham, & De Gagne (2015) The purpose of this study was to explore the lived experience of new nurses in acute care settings	10 nurses were selected for the sample Acute care setting in Florida Participants were selected based on professional experience and it excluded any nurses that had previously been LPN's	A Descriptive Phenomenology approach was used to explore the lived experience of new nurses in the first 12 months in the acute care practice environment A demographic questionnaire was provided to the participants to complete at the end of each interview Open ended question interviews were used Interviews were recorded and then computer transcribed	Themes that emerged from the study consisted of: Knowledge Skill Environment Many new nurses found it difficult to bridge the knowledge gap and would have required additional orientation or training to feel competent in the knowledge and skills of the acute care setting Many nurses felt that they lacked the practical skills required for the position	Approval from the institutional review board was obtained This study was conducted based on only the narratives of the nurses in Florida which makes it not generalizable Small sample size	This study can allow facilities to conduct further research on retaining nurses in acute care areas and how practice patterns can increase the knowledge gap and skill acquisition

		Colaizzis (1978) phenomenological method of data analysis was used and broken down into meaningful units derived as themes			

Name, Author, Date, Study, Objective	Sample/Group (size, setting, characteristics	Design and Methodology	Key Results/Findings	Strengths/limitations	Conclusions
The culture of vascular access cannulation among nurses in a chronic hemodialysis unit Wilson, Harwood, Oudshoorn, & Thompson (2010) The prurpose of this study was to describe the cannulation experiences of hemodialysis nurses and exploring nurses practice	Sample size consisted of 10 hemodialysis nurses All participants were female The hospital was located within an urban academic health center in Canada Observation of cannulation by the nurses were done by a research assistant at different times of the day with varying patients In-depth interviews were also conducted	Ethnographic research design utilized using qualitative methods Semi-structured interview tool was used All interviews were audiotaped and transcribed Demographic forms were also filled out requesting information about gender, years of experience and years of dialysis experience Interviews were transcribed verbatim and then key themes identified Once key themes were agreed upon	Themes that emerged from the study included: Lack of fistulas Fistula as a hard sell The skill of cannulation Assembly line dialysis The perpetual novice The data reveled from the perpetual novice that nurses felt they lacked the skill due to opportunity and adequate skill acquisition. Some nurses that had transferred to the dialysis unit felt that others expected them to be expert based on past nursing experience	<u>Limitations</u> Small sample size Not generalizable to nurses cannulating AVF's The nurses in this study indicated they liked to cannulate. The results may have been vastly different had junior nurses been in the study Not representative of other units providing hemodialysis	This study highlights the value in experience and proper cannulation. Additional studies could be helpful in changing educational and practical guidelines in healthcare

		by participants then focus groups were used to enhance these themes	Nurses indicated there are fewer opportunities to develop and maintain the skill of cannulation		

Name, Author, Date, Study, Objective	Sample/Group (size, setting, characteristics	Design and Methodology	Key Results/Findings	Strengths/limitations	Conclusions
Moving beyond the "perpetual novice": Understanding the experiences of novice hemodialysis nurses and cannulation of the arteriovenous fistula Wilson, Harwood, & Oudshoorn (2013) The purpose of this qualitative study was to explore the concept of the perpetual novice within the culture of a hemodialysis unit. Also, the	A hypothetical sample size of 10-12 nurses was proposed at outset. Inclusion criteria was any HD nurse who self-identified as anything but an expert cannulator However, due to lack of participation, data collection was stopped after 9 interviews The 9 participants averaged 17 years work nursing experience with an average of only 3.3 years in	The interview was an 8-item semi-structured interview tool lasting about 45-60 minutes. Interviews took place in a private setting away from HD unit. All interviews were audiotaped and transcribed verbatim	Results revealed the interplay between personal and environmental factors as contributing to the perpetual novice cannulator Personal factors included confidence level. Some nurses feel competent and actively look for cannulation opportunities. In contrast, it was evident that avoidance does occur Interpersonal relationships between nurses were also a contributing factor to	The authors suggest that experienced nurses are able to draw on past experiences and have increased confidence when in certain situations There was an initial problem with recruiting nurses and inclusion criteria had to be changed Small sample size and not generalizable to other nephrology units Nurses who participated self-identified as novice cannulator as opposed to using an	

study aimed to identify elements impeding advancement of AVF skill acquisition.	HD. All participants were either casual or part-time (i.e. none were full time)		avoidance. Participants identified 2 instances of avoidance. Firstly, when patient requested a different nurse. Secondly, when a nurse needs assistance with a difficult AVF. There were reported variation in comfort level when seeking support Environmental factors included limited learning opportunities, patient needling preferences, unit flow and time pressures and continuity of care	objective measure of cannulation skill Unknown if nurses were actually novice cannulator	

Appendix B

Consultation Report

Importance of a Teaching Resource Manual for Novice Registered Nurses on Cannulation of Arteriovenous Fistulas

Yvonne Keats

Memorial University of Newfoundland

Supervisor: Professor Mary Bursey

The development of a teaching resource manual can be utilized for cannulation skill acquisition for novice registered nurses and assist in increasing overall knowledge while also enhancing patient outcomes. In order to demonstrate the benefits of this resource, consultations with key stakeholders were conducted for current information. The advanced practice competency of consultation was utilized to ensure that evidence-based practice and expertise of staff guided the trajectory of the project. Consultation is a competency that will be evident throughout the entire development of this manual. The ability to consult with colleagues across sectors and at the organizational, provincial, national and international level is a characteristic of nurses in advanced practice (CNA, 2008). This Consultation Report will describe the results of the interviews with novice registered nurses, expert nurse cannulators, Vascular Access Nurse, Clinical Nurse Educator and a Nurse Practitioner that works in Nephrology in London, Ontario. I will also include anecdotal data from my personal experience as a dialysis nurse for three years in this specialty area.

This Report will include the following: background of the proposed project with a brief introduction explaining the overall purpose of the practicum project and the rationale for the consultations. I will then provide a summary of the participants and the methods used for the consultations such as, recruitment and data collection. I will describe the management and the analysis of the data. I will then describe the results of the consultations and implications for practice.

Practicum Project Background

In Canada, the number of people that are diagnosed with kidney disease has tripled in the last two decades. Kidney disease is a serious chronic illness that poses a challenge not only to those living with the disease, but also to their families, communities and the health care system (Public Health Agency of Canada, 2013). Hemodialysis is a life extending treatment that is offered to patients with end stage kidney disease (ESRD) (Canadian Institute for Health Information, 2011). The province of Newfoundland and Labrador has the highest rate of newly diagnosed patients over the age of 65 years with ESRD in Canada (Barrett, Butler, Bornstein, Doyle, & Gilliam, 2008). It is compounded by an increased number of older patients with more co-morbidities being offered dialysis. In January 2008, there were 380 patients on dialysis in this province, 65% of these patients were being treated by hemodialysis in main hospital-based dialysis units in St. John's, Corner Brook, and Grand Falls-Windsor (Barrett et al., 2008). As a result, patients with ESRD require a vascular access such as an AVF for the successful delivery of the hemodialysis treatment.

Vascular access is the most essential requirement for the delivery of hemodialysis among patients with ESRD. It is considered the lifeline for individuals on hemodialysis and has a huge impact on clinical and patient outcomes (Mbamalu & Whiteman, 2014). The AVF is considered the first choice of treatment for patients. This is supported by Clinical guidelines in Canada that recommend the AVF as the ideal choice for access type in hemodialysis patients (Wilson, Harwood, & Oudshoorn, 2013). In a multiple observational study conducted in seven countries (France, Germany, Italy, Japan, Spain, the United Kingdom, and the United States) of patients receiving hemodialysis in agencies, Young et al. (2000) found that that mortality rates increased with the use of internal jugular catheters and arteriovenous grafts as opposed to using the AVF as a method of treatment. There was a 32% increased risk of death in patients using an intrajugular

catheter for hemodialysis and a 15% increased chance in those with arteriovenous grafts compared to an AVF. The AVF is a more desirable choice for access compared to the central venous catheter (CVC), due to its decreased risk of bloodstream infections, low hospitalization rates, and better survival rate (See, Shugart, Lamb, Kallen, Patel, & Sinkowitz-Cochran, 2014). Patients receiving hemodialysis are at an increased risk of bloodstream infections because of repeated access of the bloodstream. In addition, the risk for developing invasive infections is greater than that of the general population (Arora et al., 2013; Kallen, Arduino, & Patel 2010). Given these findings, the AVF is considered the most optimal vascular access choice for patients requiring hemodialysis because of its longevity and low incidence of morbidity and mortality (Santoro et al., 2014; Van Loon, Kessel, Van Der Sande, &, Tordoir, 2009).

Current research shows that the AVF is the safest access choice for patients in the dialysis setting. It then becomes crucial that front line nurses have the proper cannulation skills and resources that are required to needle this complex access for patients. Numerous complications can arise from improper cannulation of an AVF such as, hematoma, aneurysm formation, infection, and missed cannulation requiring multiple needling (Van Loon, Kessel, Van Der Sande, & Tordoir, 2009; Wilson et al, 2013). In a study by Moist, Trpeski, Na, and Lok (2008), changes in practice patterns in dialysis facilities were seen as a complication to the longevity of the patients AVF. Therefore, a need exists for a consistent psychomotor competency for AVF cannulation in the clinical setting. This evidence suggests that nurses working in specialty areas like hemodialysis must be properly trained and orientated in the care of this type of access, in order to achieve optimal patient outcomes (Pile, 2004). Improper cannulation techniques can result in damage to the AVF and will impact the treatment of the patients.

Purpose of Consultations

Although there are resources available to novice registered nurses for cannulating fistulas, it is often times overwhelming. Nursing educators are increasingly challenged to find adequate clinical experiences to prepare nurses for practical demands. Limited exposure to patients brought about by varying preceptor techniques directly impacts the opportunities for experiences with certain types of cannulating situations (Rhodes & Curran, 2005). The purpose of completing consultations with key stakeholders in relation to AVF cannulation is to gain information and their perspective on skill acquisition. If novice nurses are not adequately prepared with knowledge and practical skills patient outcomes can be negatively impacted during the hemodialysis treatments.

Participants

Consultations were conducted with novice registered nurses, expert cannulator, Clinical Nurse Educator, Vascular Access Nurse and a Nurse Practitioner in Nephrology at Health Sciences Centre, London Ontario. The recruitment process for these key stakeholders simply involved an explanation of the proposed practicum project and my role as a graduate student in the Master of Nursing Program. Each participant was asked if they would be willing to participate in the consultation process and that confidentially would be maintained at all times. Prior to the consultations a Consultation Plan was submitted to my Supervisor, Professor Mary Bursey for content validity. The Health Research Ethics Authority (HREA) screening tool that was provided for the purpose of this project was completed and is attached as a document of this Consultation Report (see Appendix B). This screening tool was utilized to determine if this teaching resource manual would need approval from an Ethics Review Board. This screening tool checklist was

performed and it was found that ethical approval was not needed for this project. Mrs. Linda Ivany, Regional Manager of the Dialysis Program was contacted in person and approval was granted to conduct this project and also the semi-structured interviews with staff. I obtained both verbal and written consent from Mrs. Ivany prior to the start of this project. An e-mail of support for the project was sent to my Supervisor. Permission was granted from each nurse individually and each person was informed that if they did not want to participate in the consultations they could withdraw at any time.

Four novice registered nurses, the target population were consulted and interviewed as a group to gather pertinent information pertaining to the development of a teaching resource manual. I conducted this informal interview at the acute care hemodialysis facility at the Health Sciences Centre on April 18, 2016. The perspective of these novice nurses is important in the development of the manual. It provided information specific to the orientation and cannulation skills that will improve skill acquisition.

I also interviewed three experienced nurses in hemodialysis that are considered expert cannulators to gather information on what they think would improve novice nurse's performance with cannulating AVF's independently and accurately. These nurses have been working in the hemodialysis unit for over ten years. The Vascular Access Nurse is another consultation that was conducted for the development of this teaching manual. Mrs. Betty Ann Curran has been a hemodialysis nurse for over 20 years and the Vascular Access Nurse for several years at the Waterford Hospital, St. John's, Newfoundland and Labrador (NL). It was necessary to consult with her as she has expert

knowledge and skill with AVF cannulation. The knowledge I received from this expert will help guide and direct the development of the manual. She has experience in maintaining the longevity of the AVF and how nurses can acquire skill acquisition to ensure optimal patient outcomes. The Clinical Educator in hemodialysis, Mrs. Cathy Cake was another important consultation to the project. She plays an integral part in the orientation and education of novice nurses to the Dialysis Program. The Clinical Educator is aware of the current orientation and what skills nurses are lacking in the first few months in this specialty area. Another consultation was conducted via email with Dr. Lori Harwood. Dr. Harwood is a Nurse Practitioner who works in Nephrology at the London Health Sciences Centre, London, Ontario. I have also provided anecdotal data based on my experience as hemodialysis nurse working for three years in this specialty area. I feel my experience and perspective surrounding AVF cannulation skill acquisition will assist in guiding the development of this manual.

Methods

The primary method of data collection for these consultations was informal interviews conducted in-person or via email. The interviews with the novice nurses and expert cannulator were conducted on April 18, 2016 at the Health Sciences Centre, St. John's, NL in a quiet area of the Hemodialysis unit. Interviews with the other participants took place over several meetings either in-person or via email. Approval for the interview questions occurred prior to the conduction of the consultations. Permission to utilize these questions was obtained by my Supervisor Professor Mary Bursey. The questions utilized for the interviews were developed to gain perspective on what each key

stakeholder felt should be included in this manual to improve skill acquisition of the AVF for patients. The list of approved questions can be found in an appendix of this paper (see Appendix A).

Data Analysis

During the interviews I informed the participants that names would not be used and confidentiality would be maintained at all times. Throughout the interviews I ensured that I took notes based on the comments of each participant. Once the interviews were completed I transcribed the content of the interviews into a Microsoft word document on a password-protected computer. The information from these interviews were reviewed then analyzed for similar themes.

Consultation Results

The novice nurses interviewed all described feelings of fear and anxiety surrounding the process of AVF cannulation. The nurses all stated that lack of confidence and skill contributed to this anxiety. Several nurses' reported that lack of exposure to patients with AVF's contributed to feelings of apprehension surrounding the process of cannulation. Depending on which hemodialysis facility you are placed to work, there may not be numerous fistulas to acquire the expertise. Some nurses stated that the limited number of patients with fistulas hindered skill acquisition. Even though the nurses felt that the skills obtained in orientation were beneficial for learning about AVF cannulation they all expressed a need for additional exposure to gain confidence. New graduates, novice nurses, felt they needed more exposure based on their level of experience as a

brand new nurse. Similarly, experienced nurses working for twenty years, but new to the specialty area of dialysis expressed similar anxiety with cannulation but expressed confidence in skills obtained in previous clinical areas.

The nurses all expressed that a teaching resource manual would be beneficial for novice nurses cannulating AVF's. All nurses stated they receive a binder during orientation,/However, a manual specifically dedicated to AVF cannulation would be useful for knowledge and skill development. The nurses stated the importance of understanding assessment of the AVF prior to cannulation. They all commented that a manual with pictures of various fistulas and areas that are dangerous to cannulate to prevent damage would be essential as a novice nurse. Some nurses reported that the knowledge gained regarding AVF cannulation was theory driven and the need for increased practical skills was imperative to become knowledgeable and comfortable with troubleshooting AVFs. Other nurses reported that having a meeting a few weeks post-orientation would be beneficial in identifying areas of improvement or additional learning needs that may be needed surrounding cannulation.

The nurses reported that exposure to cannulation on a continuous basis in the orientation period provides basic skills that are needed to successfully and safely perform AVF cannulation. The importance of staff support in assisting novice nurses with cannulation was also repeatedly discussed as a means of improving skill acquisition. The nurses stated that a teaching resource manual targeted at cannulation would provide the learner with consistent information allowing all nurses to receive the same information and skill exposure. In addition, the nurses commented that by accompanying several

nurses during AVF cannulation they would observe various cannulation and troubleshooting techniques for patients.

The nurses also reported that it would be useful if the manual included the role of the senior staff or mentors in an effort to increase ongoing support and continued education. Nurses expressed they lacked experience in cannulation and reported fear and anxiety in asking a senior staff nurse for assistance.

The expert cannulator that was interviewed reported that a teaching resource manual would be valuable to have on the unit and during orientation as a guide when new nurses need assistance or have trouble with AVF cannulation. The nurses stated that a manual cannot replace the practical skills that are needed to become an expert in AVF cannulation, but a resource combined with skill application would provide valuable skills and techniques. The nurses discussed the importance of providing a strong foundation for novice nurses prior to cannulation to increase comfort level and reduce anxiety. The nurses conveyed that when new nurses are adequately prepared with proper assessment and troubleshooting skills prior to cannulation, increased confidence and skill acquisition allow for increased success.

The nurses also agreed that a section outlining the roles of the mentor or preceptor would be helpful in supporting ongoing education and allowing these mentors to understand their role in facilitating skill acquisition. The nurses interviewed also emphasized the need for novice nurses to understand the importance of assessment prior to cannulation. For example. the importance of maintaining longevity and patient outcomes. The expert cannulator emphasized the importance of a thorough assessment

prior to cannulation to ensure success. Importance of understanding policies and procedures was also another area that the participants felt needed to be included in the manual. The nurses interviewed stated it would be beneficial to have the policies and procedures for AVF cannulation included in the manual as a quick guide to cannulating according to Eastern Health Authority.

As a nurse working in the dialysis unit for three years I have provided some anecdotal information based on my personal experience as a novice registered nurse in this specialty area. I think that a teaching resource manual focused primarily on AVF cannulation would be a vital asset for nurses in orientation and also as a guide to assist them in establishing skill acquisition. As a new nurse I felt very anxious and fearful with cannulating an AVF. Cannulating for the first time is very anxiety inducing for both the patient and the nurse. Having new nurses prepared with increased assessment skills and knowledge would increase confidence and reduce anxiety. I also think the manual should focus on assessment skills and the importance of troubleshooting and manipulating needles when problems occur during a treatment. Having a resource manual that presents some case studies of common problems that can occur and ways to prevent or stop further issues would be an asset to new nurses in developing troubleshooting skills.

As a new nurse, you often lack the practical skills needed to troubleshoot problems. However, with relevant preparation these situations would be easier to problems solve and resolve for the patient. I also feel that it would be advantageous to have a meeting a few weeks post-orientation to identify additional learning needs or problem areas that may require additional training. New nurses would be able to identify

areas they feel they have improved and areas where they feel extra attention and assistance is needed with AVF cannulation. I think this would provide a safe and positive environment between the novice nurse and the mentors to work in collaboration in achieving skill acquisition. I also believe that the role of the mentors or preceptors needs to be clearly defined in terms of their role and objectives. Having numerous mentors is an asset is terms of developing various skills, but I feel the role of the mentor needs to be consistent in terms of teaching and preceptoring. A new nurse needs to have a consistent and concise knowledge base to enhance skill acquisition. Having new nurses comfortable in palpating and assessing an AVF would be useful in increasing confidence and skill. Similar to some of the novice nurses interviewed, I also think that new nurses should spend a week increasing assessment skills both in the unit and classroom setting. This would allow the nurse to become comfortable with touching an AVF and have the patient become familiar with a new cannulator.

The Clinical Nurse Educator when consulted also reported that a teaching resource manual dedicated to cannulation would be beneficial to new nurses in developing skills and techniques. The participant conveyed that she is currently averaging one orientation a month with novice registered nurses. The Clinical Nurse Educator reported that introducing this manual to new staff during orientation would provide an opportunity to initiate an additional resource for direction and guidance in terms of cannulation. The nurse interviewed discussed the importance of the clinical assessment for novice nurses prior to cannulation and stated that this should be covered in great depth in the teaching resource manual. The nurse also commented that the use of ultrasound-

guided cannulation would be very beneficial for novice nurses in understanding the AVF and its function. The Clinical Nurse Educator also spoke of the importance of the manual containing information for new nurses surrounding the care and education of AVF's for patients to ensure longevity and increased patient outcomes. Lastly, the Clinical Nurse Educator reported that this manual should contain information focused for the preceptor in terms of roles and responsibilities so that the novice nurse feels supported and the education provided is consistent. The vascular access nurse was consulted regarding the teaching resource manual on cannulation. This nurse also reported the assessment of the AVF needs to be covered in depth so that novice nurses have a strong foundation prior to cannulation. The importance of in-depth troubleshooting of a fistula was another area highlighted in the interview as imperative to skill acquisition in AVF cannulation.

Another consultation that was conducted via email was with Dr. Lori Harwood. Dr. Harwood is a Nurse Practitioner that works in Nephrology at the London Health Sciences Centre London, Ontario. This expert reported that a teaching resource manual targeted at cannulation would be beneficial for acquiring skill acquisition and knowledge development. She reported that it would be valuable to provide the manual electronically so that it is easily accessible to nurses. Dr. Harwood stated it would be advantageous to include some vascular access guidelines from the Canadian Association of Nephrology Nurses and Technologists (CANNT) when developing this manual. She also emphasized that it would be important to consider the utilization of the ultrasound for novice cannulators to guide and enhance their skills. Dr. Harwood highlighted that further attention needs to be placed on patient assessment and preparing the patient ahead of time

to help them relax and prepare for the cannulation. She also emphasized the importance of encompassing patient-centered care and teamwork in the manual as it contributes to successful outcomes.

Implications and Conclusion

The results obtained from the consultations with key stakeholders have contributed to several implications in the development of this teaching resource manual for novice registered nurses pertaining to AVF cannulation. The consultation portion of the project was essential in determining if a project of this nature is warranted and useful for novice registered nurses entering the specialty area of hemodialysis. The results obtained from the consultations strengthened the information that was learned through the integrated literature review. The importance of increased support and mentorship role responsibilities was seen as beneficial to the manual. The need for increased development in assessment and troubleshooting skills prior to cannulation was seen as vital to skill acquisition. Increased exposure to cannulation experiences was seen as a mandatory aspect of enhancing cannulation skills. The use of ultrasound guided technology for novice nurses was a new aspect of skill acquisition that I had not seen in the literature review. The use of ultrasound-guided cannulation would be valuable for hands on learning. The value of having a meeting with novice nurses post-orientation was seen as important in identifying additional learning needs of the novice cannulator. The next step in the actual development of the teaching resource manual will be using the results obtained from these consultations with key stakeholders to guide the content focusing on novice nurses and the performance of cannulation of AVFs for patients.

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Appendix A

Semi-Structured Interview Questions for Novice Registered Nurse

What aspect of orientation do you feel needed improvement with regards to cannulation?

Do you think that shadowing the same expert cannulator rather then following numerous nurses during orientation would impact cannulation skills?

What resources are available to novice registered nurses if they encounter issues with cannulation?

Do you feel novice nurses would benefit from a teaching resource manual focused on cannulation of an AVF?

What aspects of cannulation do you feel should be included in the manual?

Questions for Clinical Educator

What is currently in the orientation package in relation to cannulation of an AVF?

What practical skills do novice registered nurses receive before cannulating independently? Are there steps in place to determine if they are ready to needle?

Are there any novice nurses who require need additional orientation due to improper cannulation?

In your opinion are there any aspects of AVF cannulation that create anxiety for novice registered nurses?

Do you think having a teaching resource manual would benefit novice registered nurses?

Questions for Expert Cannulator

What are the most common cannulation issues you have seen in novice nurses?

What do you feel should be included in the teaching resource manual?

What would you add to this manual based on your years of experience in cannulating AVF?

Questions for Vascular Access Nurse

How much importance should be placed on the assessment of an AVF?

What do you think should be included in this teaching resource manual?

Appendix B

Health Research Ethics Authority Screening Tool

	Question	Yes	No
1.	Is the project funded by, or being submitted to, a research funding agency for a research grant or award that requires research ethics review	❒	☑
2.	Are there any local policies which require this project to undergo review by a Research Ethics Board?	❒	☑
	IF YES to either of the above, the project should be submitted to a Research Ethics Board. **IF NO** to both questions, continue to complete the checklist.	❒	☑
3.	Is the primary purpose of the project to contribute to the growing body of knowledge regarding health and/or health systems that are generally accessible through academic literature?	❒	☑
4.	Is the project designed to answer a specific research question or to test an explicit hypothesis?	❒	☑
5.	Does the project involve a comparison of multiple sites, control sites, and/or control groups?	❒	☑
6.	Is the project design and methodology adequate to support generalizations that go beyond the particular population the sample is being drawn from?	❒	☑
7.	Does the project impose any additional burdens on participants beyond what would be expected through a typically expected course of care or role expectations?	❒	☑
LINE A: SUBTOTAL Questions 3 through 7 = (Count the # of Yes responses)		**0**	
8.	Are many of the participants in the project also likely to be among those who might potentially benefit from the result of the project as it proceeds?	☑	❒
9.	Is the project intended to define a best practice within your organization or practice?	☑	❒
10.	Would the project still be done at your site, even if there were no opportunity to publish the results or if the results might not be applicable anywhere else?	☑	❒

11.	Does the statement of purpose of the project refer explicitly to the features of a particular program, Organization, or region, rather than using more general terminology such as rural vs. urban populations?	☑	❒
12.	Is the current project part of a continuous process of gathering or monitoring data within an organization?	❒	☑
LINE B: SUBTOTAL Questions 8 through 12 = (Count the # of Yes responses)		**4**	
	SUMMARY **See Interpretation Below**		

Interpretation:

- If the sum of Line A is greater than Line B, the most probable purpose is **research**. The project should be submitted to an REB.
- If the sum of Line B is greater than Line A, the most probable purpose is **quality/evaluation**. Proceed with locally relevant process for ethics review (may not necessarily involve an REB).
- If the sums are equal, seek a second opinion to further explore whether the project should be classified as Research or as Quality and Evaluation.

These guidelines are used at Memorial University of Newfoundland and were adapted from ALBERTA RESEARCH ETHICS COMMUNITY CONSENSUS INITIATIVE (ARECCI). Further information can be found at: http://www.hrea.ca/Ethics-Review-Required.aspx.

Appendix C

CANNULATION OF ARTERIOVENOUS FISTULAS:

A Teaching Resource Manual for Novice Registered Nurses

Yvonne Keats, BN, RN
Memorial University of Newfoundland
Date: August, 2016

Table of Contents

Introduction

Who is this teaching resource manual intended for?

This teaching resource manual was developed for the orientation of novice registered nurses in the specialty of hemodialysis. The manual is focused on arteriovenous fistula (AVF) cannulation skill acquisition to assist in increasing novice nurses overall knowledge while enhancing patient outcomes. In addition, it can also be used as a resource for nurses looking for additional information on best practice cannulation information.

Why is this teaching resource manual important?

In Canada, the number of people that are diagnosed with end stage renal disease (ESRD) has tripled in the last two decades. Kidney disease is a serious chronic disease that poses a challenge not only to those living with the disease, but also to their families, communities and the health care system (Public Health Agency of Canada, 2013). Hemodialysis is a life extending treatment that is offered to patients with ESRD (Canadian Institute for Health Information, 2011). For the delivery of a hemodialysis treatment vascular access is an important requirement. It is considered the lifeline for patients on hemodialysis and has a huge impact on clinical and patient outcomes (Mbamalu & Whiteman, 2014). The AVF is considered the first choice of access for patients. This is supported by the clinical guidelines in Canada that

recommend the AVF as the ideal choice for access for patients receiving hemodialysis (CANNT, 2015).

QUICK FACTS

- In 2014, there were 5,269 new dialysis patients. 77% of these patients were receiving hemodialysis (Canadian Organ Replacement Register, 2016).

- The number of patients in Newfoundland and Labrador treated for ESRD in 2014 was 130 (Canadian Organ Replacement Register, 2014).

- 42,000 Canadians were living with ESRD at the end of 2013 requiring regular hemodialysis treatments and kidney transplant (Canadian Organ Replacement Register, 2016).

Chapter One: The Kidneys

Learning Objectives:

Upon completion of Chapter One the learner will be able to:

- ✓ Identify the anatomy of the kidney
- ✓ Understand the function of the kidney
- ✓ Gain knowledge in the complications that arise due to improper kidney function
- ✓ Develop insight into the process of hemodialysis and why its utilized for patients

Section 1.1: Kidney Anatomy & Physiology

The Kidney

The kidneys make up part of the complex urinary system and are considered the principle organ within this system (Thibodeau & Patton, 2007). The kidneys are very similar to lima beans in shape and are located in the retroperitoneal position in the posterior of the abdomen in the body (Thibodeau & Patton). The ureters are thin tubes that connect the kidneys to the bladder and allows urine to be propelled to the bladder by the means of peristalsis (Thibodeau & Patton). The kidneys are approximately 25–30 cm long. The urethra is a tiny tube that connects to the bladder which extends to the outside of the body. It is lined with a mucous membrane and leads from floor of bladder to the exterior of the body (Thibodeau & Patton). The main function of the kidney is to filter the blood and excrete waste in the form of urine. The kidney is known as a blood volume adjuster and maintains vital electrolytes such as sodium and potassium (Thibodeau & Patton).

Important Structures of the Kidney

- ✓ Gerota's fascia is a thin, fibrous tissue that is located on the outer aspect of the kidney (Thibodeau & Patton, 2007).

- ✓ The renal capsule is a layer of fibrous tissue that surrounds the body of the kidney, inside the layer of fat (Thibodeau & Patton, 2007).

- ✓ The cortex is the tissue just under the renal capsule and is the outer region of the kidney (Thibodeau & Patton, 2007).

- ✓ The medulla is the inner part of the kidney (Thibodeau & Patton, 2007).

- ✓ The renal pelvis is a hollow area in the center of each kidney where urine collects (Thibodeau & Patton, 2007).

- ✓ The renal artery brings blood to the kidney (Thibodeau & Patton, 2007).

- ✓ The renal vein takes blood back to the body after it has passed through the kidney (Thibodeau & Patton, 2007).

- ✓ The renal hilum is the area where the renal artery, renal vein and ureter enter the kidney (Thibodeau & Patton, 2007).

- ✓ Adrenal glands are part of the endocrine system; this group of glands and cells in the body make and release hormones which control many functions such as growth, reproduction, sleep, hunger and metabolism into the blood (Thibodeau & Patton, 2007).

Did You Know?

Most people have two kidneys, but it is possible to live with only one.

Section 1.2: Complications of Improper Kidney Function

Chronic Kidney Disease (CKD)

CKD has been classified as a progressive decline in an individual's glomular filtration rate (GFR) (Abbound & Henrich, 2010). Chronic kidney disease damages the kidneys allowing wastes to build to high levels in the bloodstream. Complications such as, hypertension, anemia, osteoporosis, nerve damage may arise due to this disease (Abbound & Henrich). Cardiovascular and neurovascular disease are also common complications that develop in patients. CKD is exacerbated by hypertension and diabetes and account for nearly two third of cases. When this disease progresses it can cause the kidneys to fail requiring lifesaving treatment such as dialysis (National Kidney Foundation, 2016).

End Stage Renal Disease (ESRD)

ESRD, is the last stage of CKD. This progression indicates that the kidneys are functioning below 15% of their normal function, and they can no longer filter the kidney (Ontario Renal Network, 2013b). When

the kidneys have progressed to this stage they are unable to function normally and excess waste and water volume start to accumulate in the patient's body slowly causing damage. (End Stage Renal Disease [ESRD] [National Coordinating Centre, 2016d). This progression can take several years before a Nephrologist diagnoses ESRD. When ESRD is diagnosed patients need hemodialysis or a kidney transplant to sustain life (ESRD NCC).

When kidney disease progresses it leads to kidney failure, which requires dialysis or a kidney transplant to maintain life (National Kidney Foundation, 2016).

Section 1.3: Hemodialysis

What is Hemodialysis?

Hemodialysis is a type of treatment that is utilized once the kidneys have failed. Most patients require three to four treatments per week, that are approximately three to four hours in length. Hemodialysis uses a machine while a dialyzer acts as the body's artificial kidney to cleanse the blood (The National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2016). It is a

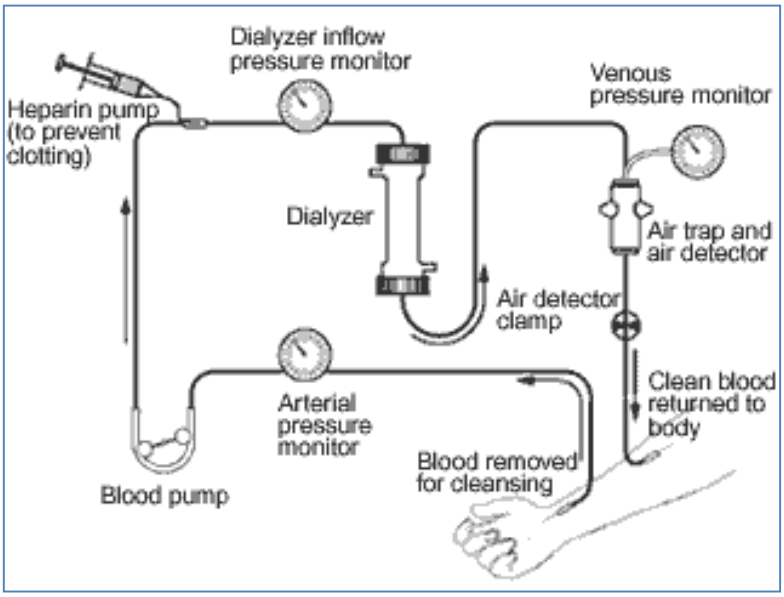
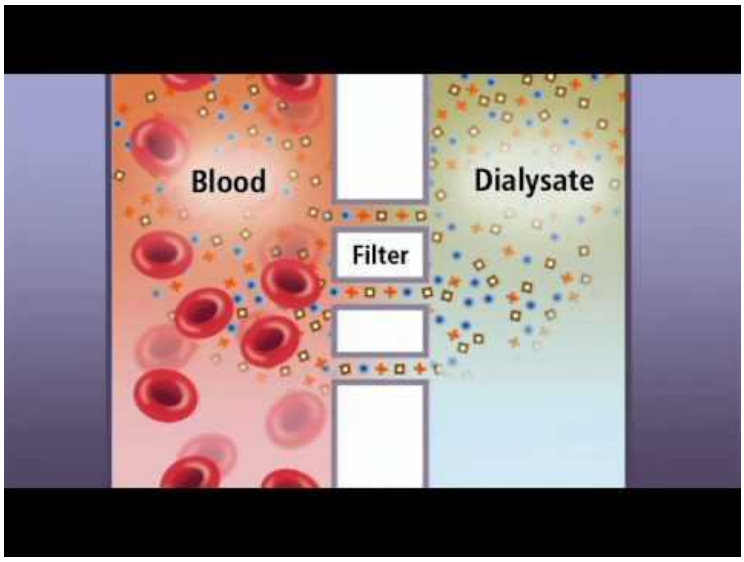


Figure 1: NIDDK (2014). Treatment methods for kidney failure: hemodialysis. Retrieved June 30, 2016 from http://www.niddk.nih.gov/health-information/health-topics/kidney-disease/hemodialysis/Pages/facts.aspx#how. Citation used under a Creative Commons Attribution licence.

semipermeable membrane designed to segregate large particles that cannot be diffused such as blood cells from smaller cells like urea and other waste products that are diffusible (Thibodeau & Patton, 2007). This occurs by passing the patients' blood over a thin membrane that

is surrounded by dialysis fluid. The waste products move through the membrane, out of the blood. They are then washed away. The larger molecules and blood cells are unable to pass through and re-enter the patient through the venous side of the vascular access. (Thibodeau & Patton). The process of dialysis is continuous one and blood is sent to the dialyzer, it is returned continually. There is approximately 300mls of blood outside of the body at any time (NDDK, 2016). Hemodialysis requires a vascular access for the delivery of treatment and patient survival is dependent on this access (Parisotto et al., 2014).

Please click on image below to observe how hemodialysis works (Increasing Kidney Awareness Network [IKAN], 2011).



Section 1.4: Test Your Knowledge

True or False

A. Cardiovascular and neurovascular disease are not common complications that develop in CKD patients. (T/F)

B. The kidneys are very similar to lima beans in shape and are located in the retroperitoneal position which is the located in the posterior of the abdomen in the body. (T/F)

C. Kidney disease can occur at any age and is exacerbated by hypertension and diabetes. (T/F)

D. ESRD is a decline in kidney function characterized by kidneys that are functioning below 30 % of their normal function. (T/F)

Section 1.5: Answer Key

True or False

A. False
B. True
C. True
D. False

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Chapter Two: Vascular Access

Learning Objectives:

Upon completion of Chapter Two the learner will be able to:

- ✓ Define vascular access
- ✓ Distinguish between the various types of vascular access

Section 2.1: What is a Vascular Access?

Vascular Access

Patients that have ESRD will require weekly hemodialysis treatments. In order to provide this life saving treatment, an appropriate vascular access is required. A vascular access allows the flow of blood through an extracorpeal circuit and back to the patient cleansed (Maleta, Vujicic, Devcic, & Rvacki, 2012) There are various types of vascular access such as the arteriovenous fistula (AVF), arteriovenous graft (AVG) and the central venous catheter (CVC) that are utilized as a patient's lifeline.

The AVF is considered the access of choice because of its longevity and lower complication rates as compared with other forms of vascular access (Besarab, 2008).

Section 2.2: Types of Vascular Access

Arteriovenous Fistula (AVF)

The AVF is the preferred type of vascular access and will be the focus of this Teaching Resource Manual. The creation of an AVF for dialysis patients involves a surgeon making a direct connection between an artery and a vein which is called the anastomosis (Santoro et al., 2014). This connection increases blood flow which allows the veins to be stronger and larger. The creation of a fistula is initiated in the wrist first, due to its ease in creation and preservation of proximal veins if additional access is needed (Ontario Renal Network, 2014).

AVF Graft

The AVF graft is a type of vascular access similar to the AVF. The graft as it is called, is created by making a direct connection of an artery and vein by utilizing a Synthetic Tube. This synthetic tube which is usually made of Teflon or fabric will allow blood to flow through the vein freely (Santoro et. al., 2014). The tube is placed under the skin and the nurse will puncture the tube during dialysis treatments. This type of vascular access is utilized when the patient vascular system is compromised and a AVF is not feasible (Ontario Renal Network, 2014).

Central Venous Catheter (CVC)

The CVC is a type of access that utilizes a flexible plastic tube that is hollow in the middle to allow blood to flow freely out of the artery and cleansed blood in through the vein. The internal jugular catheter is inserted at the side of the neck consisting of an exit and entrance site (Santoro et al., 2014). The subclavian catheter is placed in the subclavian vein under the clavicle on the chest (Ontario Renal Network, 2014). This type of access is associated with a higher rate of infection and is used on temporary basis (Santoro et al.).

Section 2.3: Test Your Knowledge

True or False

A. The AVF is considered the first choice of vascular access because of its longevity and lower complications. (T/F)

B. Connection between an artery and a vein is known as the anastomosis. (T/F)

C. The AVF utilizes a synthetic tube that is punctured during hemodialysis treatments. (T/F)

D. The subclavian catheter is placed in the subclavian vein under the clavicle. (T/F)

Section 2.4: Answer Key

A. True

B. True

C. False

D. True

References

Besrab, A. (2008). Resolved: Fistulas are preferred to grafts as initial vascular access for dialysis. *Journal of The American Society of Nephrology, September, 19,* 1629-1633.

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Chapter Three: AVF

Learning Objectives:

Upon completion of Chapter Three the learner will be able to:

- ✓ Understand the anatomy of the upper arm
- ✓ Define cannulation
- ✓ Gain knowledge in relation to the importance of the registered nurse's skill level or competence in cannulation of the AVF

Section 3.1: AVF Facts

- It is imperative that the cannulator skill level matches the fistula difficulty to ease the cannulation process and ensure success (BC Renal, 2013).

- The AVF is a more desirable choice for access compared to the CVC, due to its decreased risk of bloodstream infections, low hospitalization rates, and better survival rate (See, Shugart, Lamb, Kallen, Patel, & Sinkowitz-Cochran, 2014).

- AVF is considered the most optimal vascular access choice for patients requiring hemodialysis because of its longevity and low incidence of morbidity and mortality (Santoro et al., 2014; Van Loon, Kessel, Van Der Sande, &, Tordoir, 2009).

- Numerous complications can arise from improper cannulation of an AVF such as, hematoma, aneurysm formation, infection, and missed cannulation requiring multiple needle sticks (Van Loon et al., 2009; Wilson et al., 2013).

Section 3.2: Anatomy of AVF Access and Surgical Placement

The two most common placement sites for the AVF include the **Radial Cephalic Vein** and **Brachial Cephalic Vein.** Surgeons create a patient's AVF at the most distal portion of the arm for vein preservation in case of AVF failure. The reason for this is that they can they work the length of the arm should a new AVF need to be created for the patient (Gibbons, 2014).

Radial Cephalic Vein

The first choice for AVF creation is the radial cephalic vein which is located in the wrist and forearm (BC Renal Agency, 2013). The AVF are created distally for vein preservation and ease in cannulation and comfort to patient (Gibbons, 2014).

Brachial Cephalic Vein

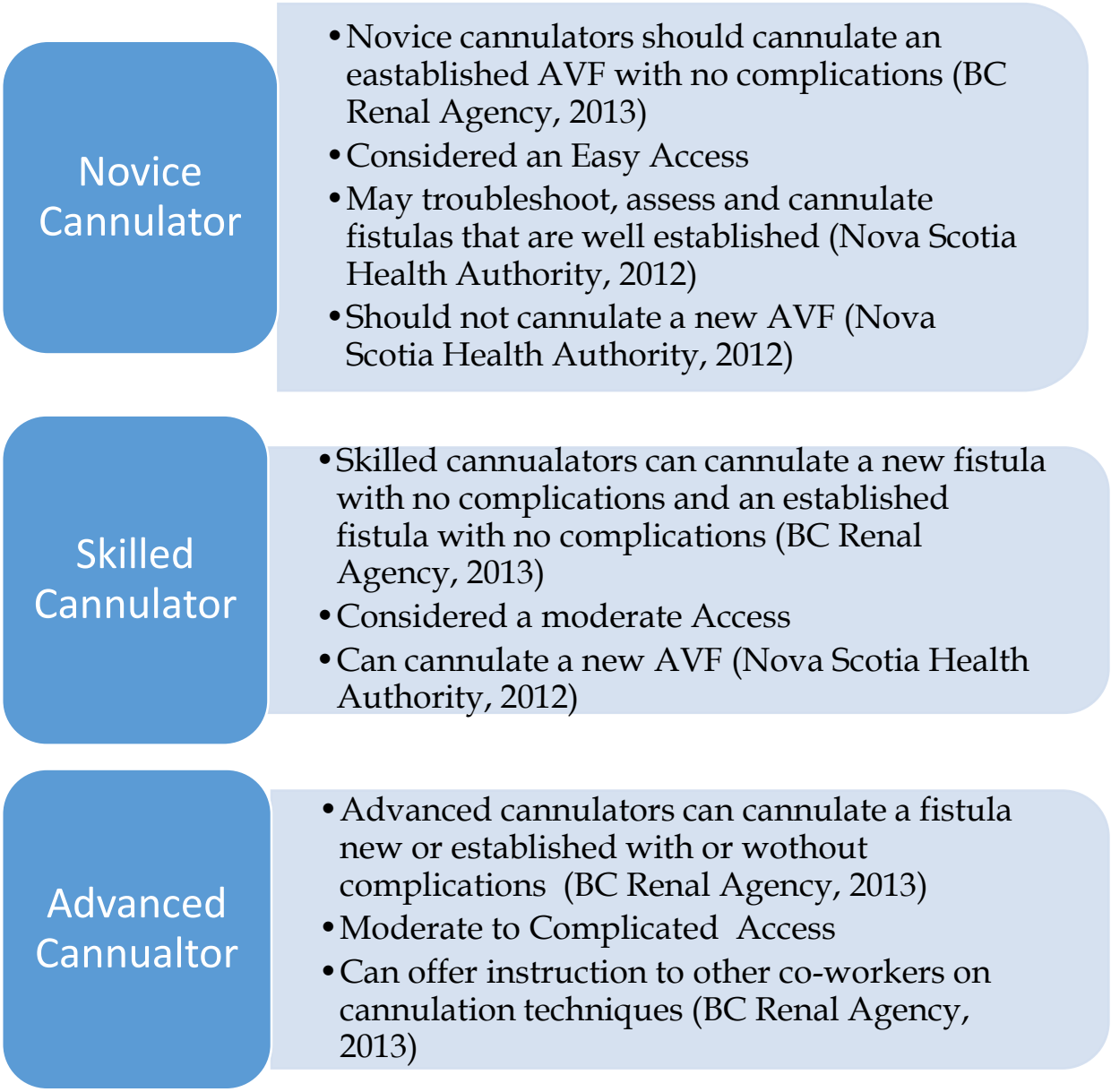
The second choice for AVF creation is the brachial cephalic vein which is located at the elbow (Bittl, 2010).

Section 3.3: Cannulation

Cannulation is defined as a process of needle insertion into an AVF. The needles are usually large bore and are inserted in the AVF arterial and venous vessel (Nova Scotia Health Authority, 2012). The process of cannulation is a crucial step and is strongly linked to the longevity of the fistula (Gallieni, Brenna, Brinini, Mezzina, Pasho, & Fornasieri, 2014). Current research shows that the AVF is the safest access choice for patients in the dialysis setting. It is crucial that front line registered nurse's cannulation skills match the fistula being accessed. Numerous complications can arise from improper cannulation of an AVF such as, hematoma, aneurysm formation, infection, and missed cannulation requiring multiple needle sticks (Van Loon et al., 2009; Wilson et al., 2013).

Section 3.4: Matching Skill of Cannulator

The diagram below is a guide for registered nurses in the specialty area of hemodialysis to follow, in an attempt to properly match the cannulator to the AVF. It is imperative to match the ***skill*** of the cannulator with the AVF to ease patient comfort and decrease complications while increasing nurse success.



Section 3.6: Test Your Knowledge

1. True or False

A. It is appropriate to cannulate an AVF when no bruit is felt but when a thrill is present (T/F)

B. An advanced cannulator can cannulate a moderate access only. (T/F)

C. A novice cannulator should only access an established AVF with no complications. (T/F)

D. The first choice for AVF creation is the brachial cephalic vein (T/F)

E. AVFs are created distally to preserve the vein (T/F)

Section 3.6: Answer Key

A. False

B. True

C. False

D. True

E. True

References

BC Renal Agency. (2013). Rope ladder cannulation for the novice cannulator. Retrieved from http://www.bcrenalagency.ca/resource-gallery/Documents/Teaching%20Tool%20Novice%20Cannulator%20June%202013.pdf.

Bittl, J. A. (2010). Catheter interventions for hemodialysis fistulas and grafts. *Journal of the American College of Cardiology, 3*, 1-11.

Gallieni, M., Brenna, I., Brunini, F., Mezzina, N., Pasho, S., & Fornasieri, A. (2014). Which cannulation technique for which patient. *The Journal of Vascular Access, 25*(15), S85-90

Gibbons, C. (2014). The snuff box fistula. Controversies and Updates in Vascular Surgery. Retrieved on July 2, 2016 from http://www.cacvs.org/pdf/presentations/Pre0024-GIBBONS%20Christopher.pdf.

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Van Loon, M.M., Kessel, A. G., Van Der Sande, F.M., & Tordoir, J.H. (2009). Cannulation practice patterns in hemodialysis vascular access: Predictors for unsuccessful cannulation. *Journal of Renal Care*, *35*(2), 82-89.

Chapter Four: Needle Placement and Size

Section 4.1: Needle Placement of AVF

Section 4.2: Needle Gauge

Section 4.3: Test your Knowledge

Section 4.4: References

Learning Objectives:

Upon completion of Chapter Four the learner will be able to:

- ✓ Identify proper needle placement of the AVF
- ✓ Understand the various needle gauges required for AVF cannulation

Section 4.1 Needle Placement of AVF

The placement of AVF needles by the novice registered nurse will greatly impact the quality of patient's hemodialysis treatments. If needles are placed in the wrong direction the fistula and patient could be harmed. This is why it is imperative to have a good understanding of why and where needles should be inserted for optimum care. The following guidelines are important and should be used during AVF cannulation.

- Placement of the **venous** needle should be antegrade which means the needle points toward the venous end in the direction of the blood flow (Nova Scotia Health Authority, 2012).
- The placement of the **arterial** needle can be either antegrade or retrograde which means against blood flow facing the arterial end (BC Renal, 2013).

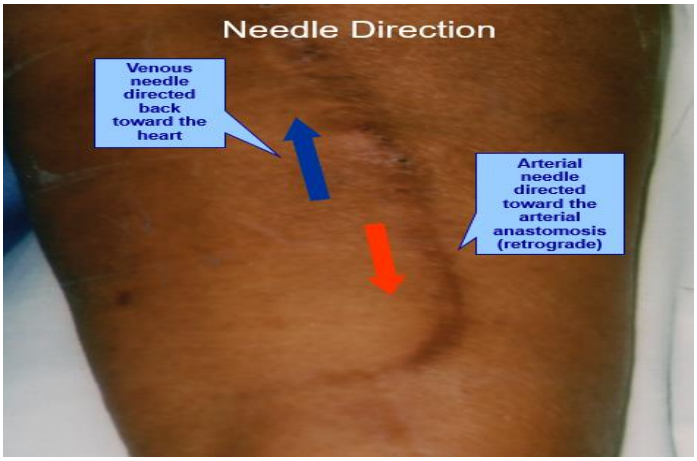

Figure 2: ESRD NCC. (2014). Needle placement. Retrieved July 2, 2016 from http://esrdncc.org/wp-content/uploads/2014/06/cannulation_of_the_AVF_Ch1.pdf Citation adapted by permission.

- The tips of the arterial and venous needles should be approximately 3 inches (7.5 cm) apart. When cannulating it is also important to remain at least 2 inches (4-5 cm) away from the anastomosis. (Nova Scotia Health Authority, 2012). The anastomosis which is where the artery and vein are connected during the creation of the fistula. The location of the anastomosis will vary depending on surgical placement.

Section 4.2: Needle Gauge

Needle Gauge

- Cannulation of initial AVF should be done with a 17 Gauge needle due to fragility of the AVF (Parisotto et al., 2014).
- 15 to 16 Gauge needles are recommended for mature fistulas to support the higher blood flow rates (Parisotto et al., 2014).
- The smaller the needle the less injury to the AVF (End Stage Renal Disease National Coordinating Center, 2016b).

Section 4.3: Test Your Knowledge

Fill in the Blanks

A. Always follow the current _____ and _____ of your Health Authority.

B. Placement of the venous needle should be _____.

C. Always ensure that when cannulating the needle is at least _____ away from the anastomosis as possible.

D. The tips of the arterial and venous needles should be approximately ____ inches apart.

E. _____ Gauge needles are recommended for mature fistulas to support the higher blood flow rates.

F. The placement of the _____ can be either antegrade or retrograde which means against blood flow facing the arterial end.

Section 4.4: Answer Key

A. Policy and Procedure
B. Antegrade
C. 2 inches or 4-5 cm
D. 3 inches or 7.5 cm
E. 15 to 16
F. Arterial needle

References

BC Renal Agency. (2013). Rope ladder cannulation for the novice cannulator. Retrieved from http://www.bcrenalagency.ca/resource-gallery/Documents/Teaching%20Tool%20Novice%20Cannulator%20June%202013.pdf.

End Stage Renal Disease National Coordinating Center. (2016b). Cannulation techniques. *Cannulation of the AV Fistula* (Chapter 6). Retrieved from http://esrdncc.org/ffcl/change-concepts/change-concept-8/cannulation-of-the-av-fistula/

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Chapter Five: Cannulation

Learning Objectives:

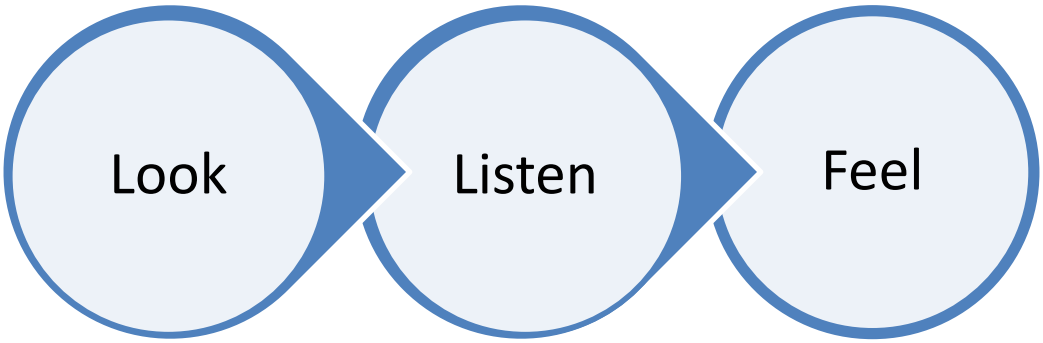
Upon completion of Chapter Five the learner will be able to:

- ✓ Identify aspects of AVF assessment skills
- ✓ Gain knowledge and insight into cannulation of the AVF
- ✓ Understand nursing care following needle removal

Assessment of the AVF must be completed prior to **every** cannulation

Section 5.1: Assessment of the AVF

Excellent ***assessment skills*** are essential in order to provide, quality nursing care. In this section of the manual, assessment of the AVF will be discussed in a systematic Look, Listen and Feel approach. The reason this is done is to ensure the entire access is assessed for any abnormalities or deficiencies that may damage the AVF or patient during treatment.



Look

- ✓ Ensure entire arm is exposed (Rushing, 2010).
- ✓ Position the patient's arm with the AVF Parallel to the floor to ensure proper visualization (BC Renal, 2013).
- ✓ When inspecting the AVF please ensure that the entire access is examined (Rushing, 2010).
- ✓ Always assess bilaterally (BC Renal, 2013).
- ✓ Look for any signs and symptoms of infection, edema aneurysms and hematomas (Rushing, 2010).
- ✓ Look for previous cannulation sites and avoid thin white shiny areas (Rushing, 2010).

Listen

- ✓ Auscultate the AVF with the aid of a stethoscope to hear the bruit.
- ✓ Start the auscultation at the anastomosis and continue the length of the access (CANNT, 2015).
- ✓ The sound of the bruit is swishing and indicates to nurse that the AVF is patent (Rushing, 2010). Click here to listen to a normal bruit.
- ✓ A clotted access will have no bruit present (BC Renal Agency, 2013).

- ✓ When steal syndrome is present the bruit will seem strong (BC Renal Agency, 2013).
- ✓ Stenosis will sound high pitched like a whistle. Click here to listen to a AVF stenosis.

Feel

- ✓ Always palpate an access prior to cannulation
- ✓ Palpate the AVF with fingertips only (Rushing, 2010).
- ✓ When palpating AVF begin at the anastomosis and continue the entire length of fistula (BC Renal Agency, 2013).
- ✓ With fingertips feel the AVF for a "Thrill" or buzz like vibration that ensures the patency of the fistula (CANNT, 2015).
- ✓ Palpate pulses distally to check the patient's circulation, feeling for capillary refill and coldness in limbs (Rushing, 2010).

Once Assessment of AVF is Complete the Nurse is Ready to Cannulate

Section 5.2: AVF Cannulation

Once the nurse has thoroughly assessed the patient's AVF it is now time to begin cannulation. In this section of the manual there are steps to follow during the cannulation process to ensure success.

Step One: Skin Preparation

- Hand hygiene is to be performed by all nurses (CANNT, 2015).

Figure 3: CDC. (2016). Handwashing: Clean hands save lives. Retrieved July 27, 2016 from http://www.cdc.gov/handwashing/. Citation used under Creative Commons Attribution license.

- Site selection should always be completed prior to cleansing the AVF (ESRD NCC, 2016a).
- AVF should be cleansed with 2% Chlorhexidine gluconate solution. Dry for 30 seconds (CANNT, 2015).
- Once the skin has been prepared it should ***not*** be touched again
- ***Never*** dab or blot the area dry. Allow the area to air dry (CANNT, 2015).

Step Two: Tourniquet Use

- The use of a tourniquet is required for all AVF cannulations (BC Renal Agency, 2013).
- Utilization of a tourniquet ensures that the AVF will dilate uniformly. A tourniquet makes cannulation easier and stabilizes the vein (BC Renal Agency, 2013; ESRD NCC Stage, 2016a).

Step Three: Cannulation Technique

- When cannulating the AVF use the L Technique, the Thumb and Index finger and place in the shape of an L (BC Renal Agency, 2013.

- Thumb holds skin taunt while the index finger engorges and stabilizes the vessel (BC Renal Agency, 2013).

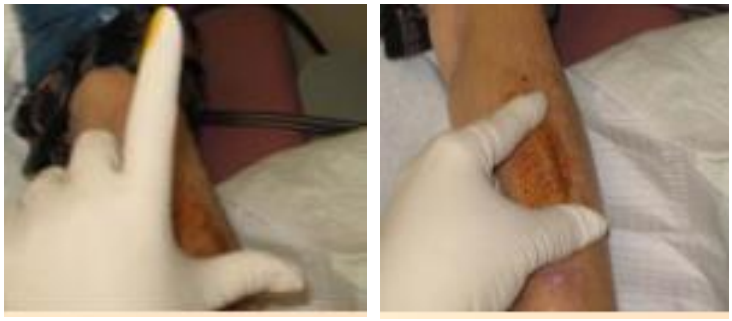


Figure 4: ESRD NCC. (2014). L Technique. Retrieved July 2, 2016 from http://esrdncc.org/wp-content/uploads/2014/06/cannulation_of_the_AVF_Ch6.pdf. Citation adapted by permission.

Step Four: Cannulation

The nurse will now cannulate the AVF utilizing the steps provided below:

- Grasp the needle by the butterfly wings and remove protective cap covering the needle. The wings act as an extension of the hands and fingers (BC Renal, 2013).
- Cannulate bevel up and use a 25-35° angle to decrease the risk of perforating the back wall of the vessel (see Figure 15). The angle of insertion is from the skin to the hub of the needle (ESRD NCC, 2016b).

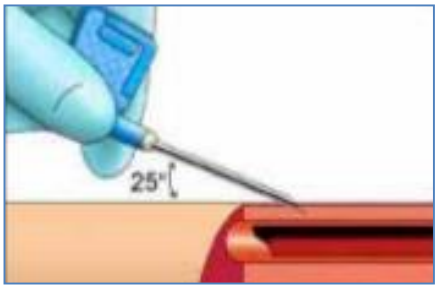


Figure 5: ESRD NCC. (2014). Cannulation of the Arteriovenous fistula. Retrieved July 3, 2016 from http://esrdncc.org/wp-content/uploads/2014/06/cannulation_ of_the_AVF_Ch1.pdf. Citation adapted by permission

- First, enter the skin and tissue with needle above the AVF, then the blood vessel itself (BC Renal Agency, 2013; CANNT, 2015).
- Avoid flipping the needle as this can cause tearing of the AVF (BC Renal Agency, 2013).
- Slowly advance the needle.
- Once the needle is through the vessel wall check for flashback. This is easily visible in the tubing of the AVF needle (see Figure 16).
- Flashback should be ***brisk***. Check for flashback by connecting a syringe to the AVF needle and gently aspirating for blood (BC Renal Agency, 2013).
- Gently flush the AVF with Normal Saline 0.9%. If flashback is absent or sluggish **do not flush needle** (ESRD NCC, 2016b).
- Secure wings of the needle at the angle of advancement. If required, place a 2x2 gauze pad under the needle wings to correct the angle (BC Renal Agency, 2013).

Step Five Securing the Needle

Once the needles have been successfully inserted in the patient's AVF secure with tape to ensure they remain in place. Here are some tips to prevent the AVF needles from dislodging during the hemodialysis treatment:

- When securing needles with tape ensure they are kept at the same angle of advancement to avoid a shift in position or infiltration (BC Renal Agency, 2013; Fistula First, 2015).
- Needles need to taped to avoid dislodgement (BC Renal Agency 2013; Fistula First, 2015).
- The needle is first fixed in place by using a rectangle piece of tape Fistula First, 2015).
- Use the Chevron method of taping (see Figure 17 below). The tape utilized to make the "chevron" is positioned close to needle tubing under the first piece of fabric tape with the sticky side up (Van Waeleghem, Chamney, Lindley, & Pancírová, 2008).

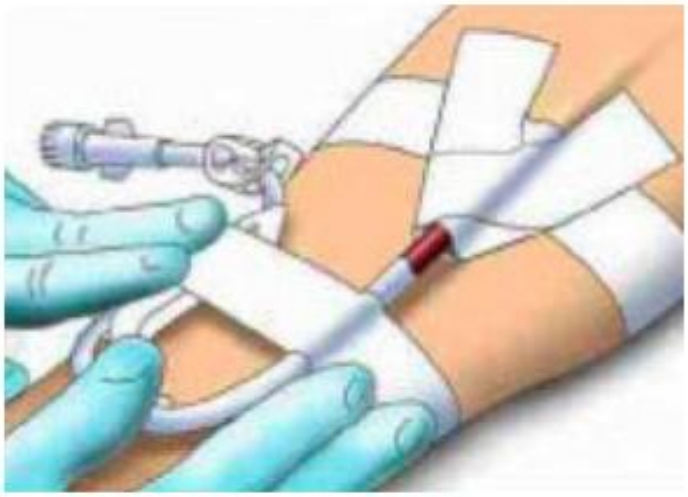


Figure 6: Fistula First (2015). Cannulation of the AV fistula. Retrieved July 3, 2016 from http://esrdncc.org/ ffcl/chnage-concepts-8/cannulation-of-the-av-fistula/. Citation adapted by permission.

- The ends of the tape are then crossed over to form the "Chevron "to secure the wings and resist tugging (Fistula First, 2015).
- AVF should be visible at all times during treatment and should not be covered up with blankets.
- Check the AVF placement during each hourly check to ensure no changes have occurred (BC Renal Agency, 2013; Fistula First, 2015).

Section 5.3: Needle Removal

Once the hemodialysis treatment has completed the registered nurse will then need to remove the needles from the AVF. Removal of a needle is just as important as insertion and needs to be performed correctly to ensure the AVF is not damaged. Below are important tips to safely remove an AVF needle:

- Always remove AVF needle at the angle it was inserted (ESRD NCC, 2016b).
- Never apply pressure to the vessel while the needle is still in the vein as this could damage or tear the vessel (BC Renal Agency, 2013).
- When the needle is out of the blood vessel completely, apply pressure with two fingers. One finger at the skin level and one at the vein level to ensure hemostasis (BC Renal Agency, 2013).
- Hold pressure to the vessel for 10-15 minutes. After 10-15 minutes it is okay to look and see if hemostasis has occurred (ESRD NCC, 2016b).

One-site-itis is a term used to define cannulating in the same sites which can lead to aneurism formation and stenosis of the AVF (BC Renal Agency, 2013)

Section 5.4: Site Rotation

Site Rotation should be completed for all AVF Cannulations to increase longevity and preserve arm veins of the dialysis patient. Below is a guide for novice nurses to follow to ensure that for each cannulation new sites are being created for the individual.

- When cannulating an AVF always rope and ladder and avoid cannulating in the same sites (ESRD NCC, 2016b). Figure 18 depicts how the rope and ladder technique should be utilized by all nurses cannulating AVF's. Cannulation in the same sites can cause damage to the fistula and impact patient outcome (CANNT, 2015).

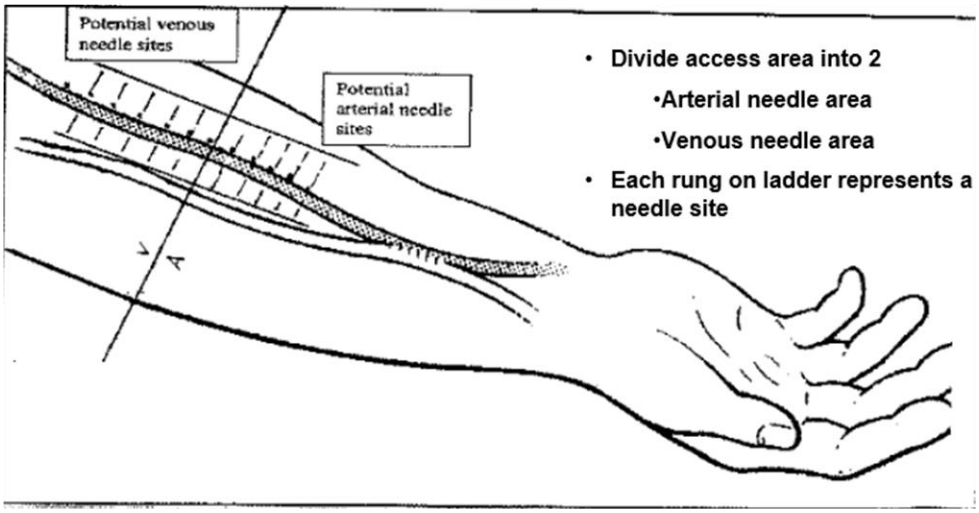


Figure 7: End Stage Renal Disease National Coordinating Center (2014). Cannulation techniques. Retrieved on June 14, 2016 from http://esrdncc.org/wp-content/uploads/2014/06/cannulation_of_the_AVF_Ch6.pdf. Citation adapted by permission.

Rotate the cannulation sites up an down the entire length of the AVF. (BC Renal Agency, 2013). See Figure 19 below.

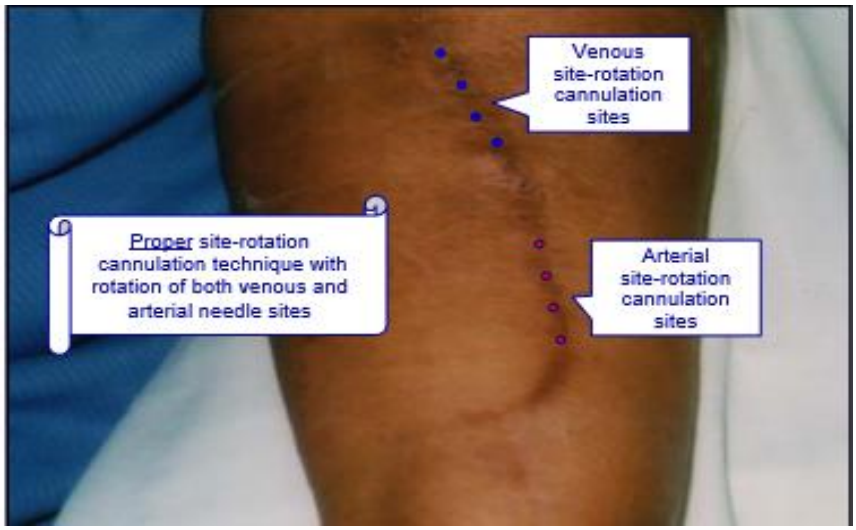


Figure 8: End Stage Renal Disease National Coordinating Center (2014). Cannulation techniques. Retrieved on June 14, 2016 from http://esrdncc.org/wp-content/uploads/2014/06/cannulation_of_the_AVF_Ch6.pdf. Citation adapted by permission.

Please click video (Ontario Renal Network. (2013a) on Assessment and Cannulation of AVF

Section 5.5: Test your knowledge

True or False

A. When preparing the site for cannulation look for previous cannulation sites and insert in the same place to avoid damage. T/F

B. The proper steps to assessing an AVF are listen, look, feel. T/F

C. A clotted access will have no bruit present. T/F

D. When taping an AVF ensure to use the Chevron method of taping. T/F

E. Cannulate bevel up and use a 25-35° angle. T/F

F. If flashback from the AVF is sluggish proceed to flush with Normal Saline. T/F

Section 5.6: Answer Key

A. False

B. False

C. True

D. True

E. True

F. False

Section 5.7 Putting it all Together

Case Study

Mr. X arrives to his hemodialysis treatment at 0730 hours. The nurse assigned to Mr. X is a novice nurse and has completed orientation six months ago. Mr. X had his AVF created several years ago and has been receiving hemodialysis for several years.

1. Who should needle this access based on the above information?

a) An expert cannulator should needle this AVF

b) The new nurse may needle this AVF as it is an established vascular access

c) New nurses should never cannulate if experienced nurses are available

d) The AVF is not mature and therefore should not be cannulated

2. The nurse is ready to begin the AVF cannulation process. What is the first step the nurse should complete?

a) Assessment of the AVF should occur prior to cannulation

b) Cleanse the AVF with Chlorohexidine Gluconate solution and then begin assessment

c) The nurse can easily see from a glance that this is an easy access to cannulate.

d) The nurse should now place the tourniquet on the patient's arm

3. The nurse begins her assessment of the AVF. What are the steps of the assessment process?

a) Feel/look/listen
b) Listen/feel/look
c) Look/listen/feel
d) Look and listen

4. When assessing the AVF for cannulation sites the nurse notices tiny marks in the same area. What is the best intervention?

a) Cannulate in these areas as it seems it was the best choice
b) Avoid these areas and use the rope and ladder technique
c) Cannulate in an area that looks shiny
d) Ask patient if this site is appropriate to cannulate

5. The nurse is ready to cannulate Mr. X's AVF. What size needles should the nurse use to cannulate Mr. X's vascular access?

a) A 17 G needle is used to cannulate
b) A 15-16 G needle is used to cannulate
c) A 20 G needle can be used to cannulate
d) A 22 G needle can be used to cannulate

6. During insertion of the needle the nurse should enter at what angle:

a) 25-30° angle
b) 90° angle
c) 15° angle
d) 20° angle

7. The nurse inserts the needle in the AVF and notices that the flashback is sluggish. What intervention should the nurse complete?

a) Proceed to flush with Normal Saline 0.9%
b) Do not flush the needle and seek assistance from an expert cannulator
c) Try to flush the needle with a little force to bypass the clot
d) Continue to flush but use the start and stop method

8. Once the nurse has inserted the needle what is the next course of action?

a) Tape the needle at the angle of insertion to avoid dislodgement
b) Never tape the needle once inserted
c) Put tape very tight so that needle is flush with patient's skin
d) Only use tape if needle is difficult to insert

9. The hemodialysis treatment is finished and the nurse has to remove the AVF needles. During the removal of these needles, what is the best intervention for the nurse to perform for the patient?

a) Never apply pressure to the blood vessel while the needle is still in vein as this could damage or tear it
b) Apply pressure to blood vessel as needle is coming out to avoid bleeding
c) Ask the patient to assist with the removal of the needles
d) When the needle is removed from the blood vessel there is no need to hold pressure

Section 5.8 Case Study Answer Key

Case Study Answers

1-B The new nurse may needle the AVF as it is an established AVF.

2-A Full Assessment of the AVF should **always** be done prior to any skin preparation.

3-C The proper assessment of the AVF is the Look/Listen /Feel approach.

4-B Always use the Rope and Ladder technique to protect the AVF.

5-B A 15-16 G needle can be used for Mr. X's AVF as it is an established fistula.

6-A 25-30-degree angle should be used to avoid damaging the AVF

7-B Never flush an AVF that is sluggish or has flashback absent as this may damage the fistula.

8-A Always tape the needles at the angle of insertion

9-A Never apply pressure to the blood vessel while the needle is still in vein as this could damage or tear it.

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End Stage Renal Disease National Coordinating Center. (2016b). Cannulation techniques. *Cannulation of the AV Fistula* (Chapter 6). Retrieved from http://esrdncc.org/ffcl/change-concepts/change-concept-8/cannulation-of-the-av-fistula/

Fistula First. (2015). Cannulation of the AV fistula. Retrieved from http://esrdncc.org//ffc/change-concepts/change-concept-8/cannuation -of-the-av-fistula/

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Chapter Six: Educational Interventions

Learning Objectives:

Upon completion of Chapter Five the learner will be able to:

- ✓ Identify common AVF complications
- ✓ Understand nursing interventions targeted at AVF cannulation
- ✓ Gain insight into the importance of nursing documentation
- ✓ Understand importance of patient education

Section 6.1 Nurse Recognition of AVF Complications

It is important for registered nurses to be able to perform proper assessment skills to recognize some common complications that can occur with an AVF. Below are complications that can impact AVF function and patient outcome. When complications arise nurses need to seek assistance from other staff or a Nephrologist.

Steal Syndrome

- Steal syndrome can arise from decreased blood supply to the hand. This is caused by the AVF stealing blood away from the extremity (Fistula First, 2015).
- This causes a decrease in perfusion to the tissues which in turn leads to hypoxia. The lack of
  oxygen to the tissues causes mild to severe pain for the patient (Ball, 2005).
- When the nurse is assessing the AVF she will notice the extremity is cold to palpate and the capillary refill will decrease (>2 seconds). The radial artery is also unable to be palpated (BC Renal Agency, 2013).
- Patient will report pain distal to anastomosis during treatment

- Impaired hand movement and strength, numbness, tingling are common symptoms reported by patients ((BC Renal Agency, 2013).

Infiltration

- An infiltration is bleeding or oozing around the needle site which leads to a hematoma (ERSD NCC, 2016d)

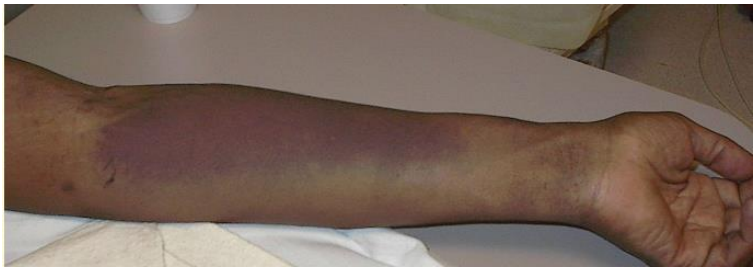

Figure 9: End Stage Renal Disease National Coordinating Center (2014). Complications. Retrieved on June 14, 2016 from http://esrdncc.org/wp-content/uploads/2014/06/cannulation_of_the_AVF_Ch6.pdf. Citation adapted by permission

- This occurs during cannulation and the patient may report immediate sharp pain, discoloration, and swelling (BC Renal Agency, 2013).
- It is important to understand that infiltrations can occur before during and after the AVF needles are removed (ERSD NCC, 2016d).
- Infiltration can occur due to improper needle insertion or removal (ERSD NCC, 2016d).

- Improper vessel pressure during removal of AVF needles can cause infiltration (ERSD NCC, 2016d).

Figure 10: End Stage Renal Disease National Coordinating Center (2016). Complications. Retrieved on June 14, 2016 from http://esrdncc.org/wp-content/uploads /2014/06/ cannulation_of_the_AVF_Ch6.pdf. Citation adapted by permission.

Aneurysm

- This is caused by a stenosis in the AVF. As the blood vessel begins to narrow the back pressure increases which cause's vessel distension and weakening of vessel wall (ERSD NCC, 2016d).
- This may also occur by repeated needling of the same sites (ERSD NCC, 2016d).

Stenosis

- A stenosis decreases the effectiveness of a patient's treatment due to reticulation of blood (Ball, 2005).
- A stenosis causes vessel wall damage, and inhibits an AVF from maturing which can lead to clotting of the AVF ((BC Renal Agency, 2013).
- When examining the extremity for stenosis, edema is a good indication that the vessel is not draining properly ((ERSD NCC, 2016d).
- The sound of the bruit will be higher pitched where the vessel narrows and louder near the anastomosis (ERSD NCC, 2016d).

Section 6.2: Nursing Interventions

When learning to cannulate an AVF, it is imperative to seek assistance from appropriate staff when difficulties arise during cannulation. Below are guidelines for novice nurses to follow:

- When cannulating is unsuccessful or infiltration occurs seek assistance from an advanced cannulator (BC Renal Agency, 2013).
- If blood cannot be aspirated back into the needle tubing **do not flush** and seek assistance (BC Renal Agency, 2013).
- If a needle appears infiltrated or is infiltrated always remove needle to reduce further damage to the patient's fistula (Fistula First, 2015).
- After one failed needle attempt always seek assistance from an expert: do not attempt to needle a second time (BC Renal Agency, 2013).

Section 6.3 Documentation:

When nurses can document a well written note with pertinent information on the patient's treatment it has the potential to enhance patient outcomes. Below are some ways that nursing documentation can assist the nurse in adjusting and improving patient care:

- Documenting allows nurse to see patient's previous status and issues (Jefferies, Johnson, & Griffiths, 2010).
- Supports continuity of care (ARNNL. 2010).
- Powerful communication tool (Jefferies, Johnson, & Griffiths, 2010).
- Provides accurate and current information (ARNNL, 2010).
- Demonstrates professional accountability (ARNNL, 2010).
- Describes the care of the patient accurately Jefferies, Johnson, & Griffiths, 2010).
- Always document in a logical sequential manner (Jefferies, Johnson, & Griffiths, 2010).
- Documentation should record variances in care Jefferies, Johnson, & Griffiths, 2010).
- Documentation should fulfill legal requirement of the nurse Jefferies, Johnson, & Griffiths, 2010).
- Documentation is a legal document and can be used in a court of law. It should follow chronological order of the events involving client care (ARNNL, 2010

Section 6.4: Patient Education

Patient education is an important role and responsibility of a registered nurse. It is not only the nurses responsibility to ensure the longevity of the AVF, but also the patients. Here are some quick tips the nurse can share with the patient to involve them in the AVF care.

- Patients should not wear any restrictive clothing or jewelry on the AVF arm (Rushing, 2010).
- Absolutely **no** venipuncture, injections or blood pressures to be taken from arm with fistula (Fistula First, 2015).
- Do not carry heavy objects or sleep on the arm with the fistula (Rushing, 2010).
- Ensure to encourage patients to embrace cannulation site rotation and insist other staff do the same (Fistula First, 2015).
- Educate patients on the importance of reporting any edema, redness, or signs and symptoms of infection (Rushing, 2010).

Section 6.5: Test Your Knowledge

True and False

A. Patients can have venipuncture, injections or blood pressures taken from their arm with the fistula as long as it is done distally. T/F

B. Patient should not wear any restrictive clothing or jewelry on the arm with the AVF. T/F

C. An infiltration is bleeding or oozing around the needle site which leads to a hematoma. T/F

D. When assessing for steal syndrome the nurse will notice the AVF extremity is cold to palpate and the capillary refill will decrease (>2 seconds). T/F

E. An aneurysm is **not** aggravated by cannulating in the same area and not rotating sites. T/F

F. If a needle is infiltrated or appears to be infiltrated initiate treatment anyway. T/F

Section 6.6: Answer Key

A. False

B. True

C. True

D. True

E. False

F. False

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Chapter Seven: Additional Resources

Section 7.1 Resources for Nurses

Learning Objectives:

The purpose of Chapter Seven is to provide registered nurses resources that are available online. These resources are reputable sites that will provide information and guidance to nurses related to cannulation of the AVF and other nephrology related issues and problems.

Section 7.1 Additional Resources for Nurses

Here are some resources that can be found online and may provide additional information for the registered nurse. Below is a list of electronic links:

BC Renal Agency

www.bcrenalagency.ca

Canadian Association of Nephrology Nurses and Technologists (CANNT)

http://www.cannt.ca/files/CANNT-VA%20Guidelines-2016Jan4-NP.pdf

Fistula First

http://esrdncc.org/ffcl/

National Kidney Foundation

https://www.kidney.org/

Ontario Renal Network

http://www.renalnetwork.on.ca

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