

**Employing Farrow Wraps as a Post-Operative Intervention to Reduce Surgical Site  
Infections in Elective Lower Extremity Revascularization**

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### **Abstract**

Surgical site infection following scheduled infrainguinal lower extremity bypass is a common complication affecting up to 30% of all patients undergoing these procedures (McGillicuddy et al., 2016). At Albany Medical Center, surgical wound dehiscence accompanied by acute limb inflammation and a need for IV antibiotic administration was a commonly cited cause for 30-day post-procedure readmission. A partnership with the company distributing Farrow wraps was established to coordinate with a multidisciplinary clinical team to investigate the efficacy of these devices as a means of reducing post-operative limb inflammation to increase wound patency and reduce readmissions associated with surgical site infections.

## **Employing Farrow Wraps as a Post-Operative Intervention to Reduce Surgical Site Infections in Elective Lower Extremity Revascularization**

According to the Vascular Quality Initiative (VQI) registry sponsored by the National Society of Vascular Surgeons, the Vascular service at Albany Medical Center (AMC) is in the top 5% nationally for annual case volume of infrainguinal lower extremity bypass. Numerous interventions such as antibiotic prophylaxis, pre-operative and daily CHG baths, decolonization of nares with mupirocin, routine perioperative cardiology and endocrine optimization, early mobility as well as the standardization of wound care using silver impregnated dressings and negative pressure devices have been incorporated into the standard of care for this surgical cohort. Despite these efforts, percentile rankings for these procedures remains unfavorable among participants in benchmarking via the American College of Surgeons National Quality Improvement Program (ACS NSQIP) and has been an area identified as ripe for quality improvement efforts.

### **Clinical Problem**

Classification of a surgical site infection (SSI) requires that purulent drainage or organisms be isolated from the surgically interrupted skin, subcutaneous tissues or deep layers occurring within 30 days after surgery. Organ space involvement can occur up to one year after surgery and includes involvement of prosthetics used during surgical repair (Kalish et al., 2014; Zabaglo & Sharman, 2021, para. 4) . Signs and symptoms of SSI correlate with the five classical signs of inflammation “redness (*rubor*), swelling (*tumor*), heat (*calor*), pain (*dolor*) and loss of function (*functio laesa*)” (Punchard et al., 2004, para. 2). SSIs in lower extremity bypasses often present 5 to 7 days post procedure and are characterized by “erythema, localized pain,

unexplained persistent pyrexia, discharge from the wound (often purulent), wound dehiscence, and problems with wound healing”(Zabaglo & Sharman, 2021, para. 6).

Patient characteristics independently associated with all SSI generally include obesity, active smoking, and comorbidities such as advanced age, CAD, COPD, diabetes, renal failure, anticoagulation use and immunosuppression. Additional associated risk factors are surgeries greater than 4 hours with blood loss requiring transfusion and hematoma development (Kalish et al., 2014). The vascular patient population presents with many of these risk factors. Lower extremity bypass procedures may last 4 hours or more, and the nature of the surgery requiring work on arterial vessels often necessitates the use of blood products intraoperatively (Pleger et al., 2017).

### **Significance**

“The relationship between SSIs and morbidity correlates with extended hospital stay, severe limb ischemia, extremity loss, massive hemorrhage, systemic sepsis and septic embolization “ (Pleger et al., 2017, para. 2). SSIs are the most common nosocomial infection in vascular surgery patients. Patients with lower extremity bypass SSI have a 92% longer length of stay (Totty et al., 2020), and are thought to cost more than \$3,000,000,000 in the U.S annually (Wiseman et al., 2015). Although previous studies have identified improvement in pain and functional ability following successful lower extremity bypass surgery (McGillicuddy et al., 2016), SSIs related to these surgeries have been implicated in up to 20,000 preventable deaths each year (Wiseman et al., 2015). This subject is germane to Nurse Practitioners practicing in primary care and to those working with the vascular patient population. These professionals play a pivotal role in medically managing patients with peripheral artery disease who have the

potential for catastrophic mortality and morbidity when SSI complications arise following surgery (Lecouturier et al., 2019).

### **Research Questions**

At AMC, numerous perioperative and intraoperative reduction practices have been adopted as standard of care evolving from Vascular Quality Improvement Team goals to reduce lower extremity bypass SSIs. As AMC transitions from NSQIP to VQI registries, additional data collected over the past year identified wound dehiscence as a common factor in the readmission of post-surgical patients. This surgical population has a constellation of known risk factors as barriers to wound healing predisposing them to SSIs. Most of these risks are unable to be mitigated prior to surgery. In considering new interventions aimed at SSI reduction, reduction in post-operative inflammation was targeted and compression and limb elevation examined. Within this context, Farrow wraps, compression devices with documented success as an intervention in venous ulcer healing were considered. An investigational study was designed to evaluate the efficacy of Farrow wraps as a post-operative benefit in patients having undergone lower extremity bypass. Success would be measured by a reduction in post-operative complications requiring readmission within 30 days. A proposal was developed and submitted for IRB approval.

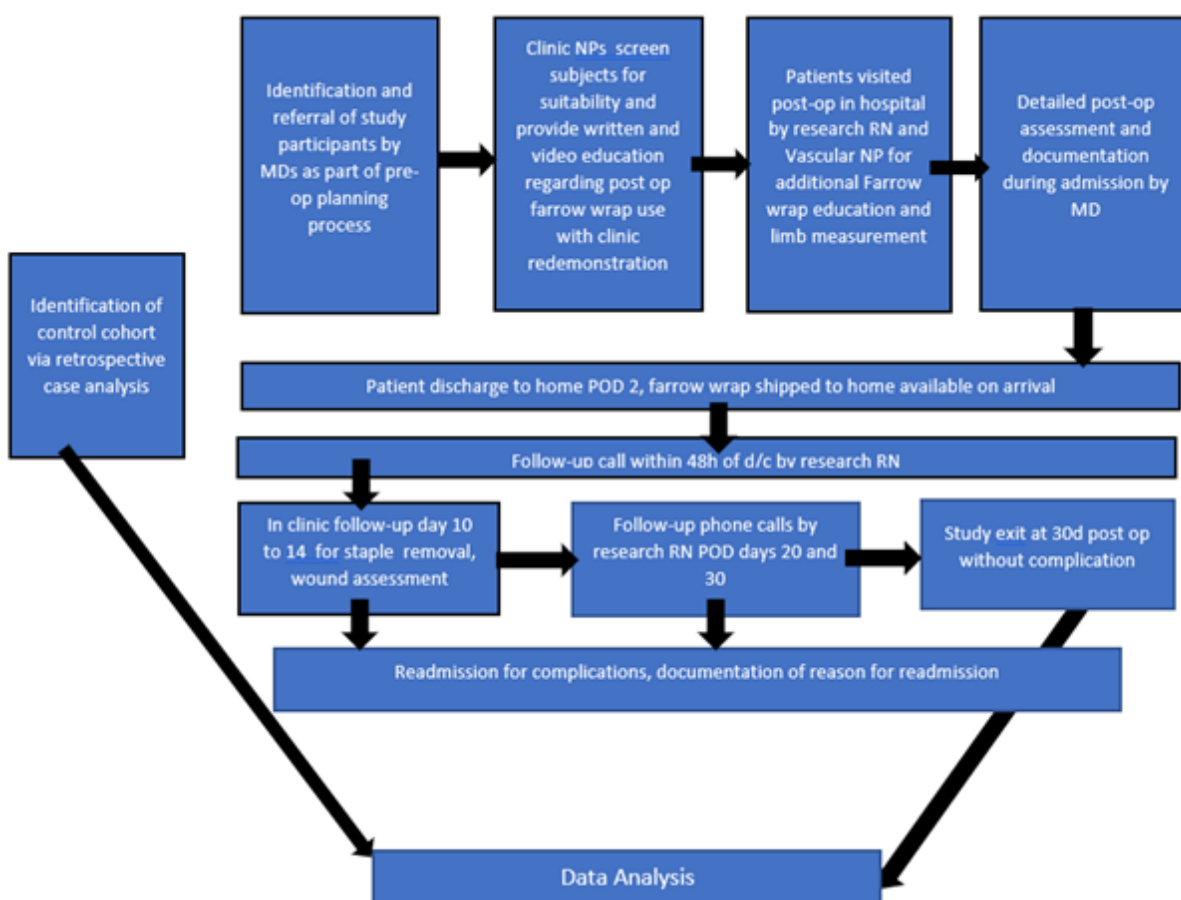
### **Conceptual Framework**

The population under study was identified as all patients with planned infrainguinal bypass for arterial limb ischemia. A retroactive study of patients readmitted for SSIs with wound dehiscence following bypass was undertaken to identify a control cohort of one hundred patients to sufficiently power results. Exclusionary criteria were identified as patients admitted for bypasses due to trauma, emergency critical limb ischemia, and a history of all previous lower

extremity surgical procedures. Patients with multiple areas of limb stenosis not corrected by surgery were also excluded. Enrollment of identified research subjects would commence until the 100-case target is met. Data comparing readmission rates due to SSI and wound dehiscence would be tabulated at study conclusion.

**Figure 1**

*Study Design*



**Literature Review**

There have been multiple studies citing the advantages of employing compression to treat lower extremity edema. In 2010, one study examined the diagnosis and treatment of chronic

lower extremity edema and the risks posed to wound healing of those affected. This study highlighted the linear relationship between abdominal girth and increased abdominal pressure that can contribute to chronic venous insufficiency (CVI). This author characterizes CVI as a proinflammatory state that renders the patient much more susceptible to bacterial infections. The author posits that many lower extremity edemas are of mixed etiology, that many patients have venous and arterial deficits, and that all will benefit from the use of compression therapy (Farrow, 2010).

The evaluation of adjustable compression wrapping devices such as the Farrow wrap has been cited in several studies by nurses in wound care journals. In 2008, Lawrence cited case studies in explaining the advantages of using multilayered adjustable wraps, such as the Farrow wrap, for ease of independent patient donning and doffing compared to other compression modalities (Lawrence, 2008). Another study examined the benefits of the easy-to-remove Farrow wrap in the provision of wound care and in the reduced time patients spent in wound clinics (Lee, 2018). Caprini and Ehmann & Bock both found that the use of Farrow wraps was superior to other modalities due to its stability in compression delivery and ability for easy adjustment as lower extremity swelling subsides (Caprini, 2015; Ehmann & Bock, 2018). Ehmann & Bock went further in recommending adjustable velcro wrap use by illustrating the potential for injury that can be caused by ill-fitting unna boots, poorly donned compression stockings and unevenly applied compression bandages but did cite the need for a baseline patient functional assessment to ensure effective use (Ehmann & Bock, 2018).

Finally, the use of compression for post-surgical lower extremities had previously been discouraged for use in cases of arterial ischemia, with the rationale that compression would further challenge arterial flow. In a 2020 consensus statement following a rigorous literature

search, compression therapy can be safely use in patients with PAD with palpable distal pulses or an ankle pressure  $>60\text{mmHG}$  and toe pressure  $>30\text{mmHG}$ , both of which are exceeded following a successful revascularization procedure (Rabe et al., 2020).

### **Plan for Implementation**

Identification of the retrospective study cohort will be performed by medical student interns as part of their first- and second-year study in hospital-based quality improvement projects. Prospective study patients will be identified by attending physicians at the initiation of lower extremity bypass scheduling. Clinic-based nurse practitioners will further vet this cohort and provide functional assessments to ensure safe and independent use of the Farrow wrap product including an in-person redemonstration of its use. Additional education will be provided via written materials and video as part of a preoperative patient education package.

Following surgery, the attending physician will complete a detailed wound assessment on each study participant. A research nurse responsible for the study will visit the patient and confirm the information provided by the physician. The research RN will also visit the patient with the inpatient nurse practitioner to measure the patient's limb and order their Farrow product, which will be shipped via 24-hour delivery to the patient's home at no cost to the patient.

A post-discharge phone interview will be conducted 48-hours after discharge to answer questions regarding Farrow wrap use and provide troubleshooting if needed. The patient will attend a clinic follow-up appointment 10 to 14 days following discharge, where staples will be removed, and wounds and Farrow wrap use will be further assessed and measured. The patient will receive a follow-up phone calls from the research RN on post-operative days 20 and 30 to check on progress and monitor wound status and Farrow wrap compliance. Patients without complications will be considered to have completed their participation at day thirty post



discharge. Patients admitted prior to this interval will be surveilled for complication outcomes. At the conclusion of one hundred cases, data will be tabulated comparing the SSI rates with readmission for the control and active study groups.

### **Plan for Sustainability**

Should the compressive Farrow wraps prove beneficial as a tool in the reduction of lower extremity SSI rates following bypass, the largest barrier to use will be funding the acquisition of the product. Due to insurance billing, Farrow wraps are covered by insurance for outpatient use only, which is the reason the wraps will not be applied until the patient goes home. If benefit is found, the next step would be the provision of cost information to the hospital value analysis group at for consideration as part of hospital provided post-operative care. In comparison of the cost of currently used on products in the provision of the standard of care for these patients, there is optimism that a request to use the Farrow wraps inpatient would be granted.

Additionally, if SSI reduction benefit is found, use of the Farrow wraps could be extended to include a wider range of lower extremity bypass patients, including those with functional deficits residing in assisted or facility living. Patient expansion could also be considered for those with initial hospital stays past POD 2 due to other variables, or those undergoing unplanned procedures. Other topics for consideration for future study include the possibility of study expansion to include anti-inflammatory medications, diuretics, or steroids as adjunct therapies to decrease post-operative limb swelling.

### **Plan for Evaluation of Patient Outcomes**

The initial goal for this project is to determine if the Farrow wrap compression garments provide benefit in reducing post-operative swelling that promotes wound dehiscence and contributes to SSI following lower extremity bypass. This will be evaluated based on the

comparison of readmission rates in the pre and post intervention cohorts. Secondly, another goal of this project is to evaluate the meaningful use of this product in a cohort that is elderly, with associated physical limitations due to multiple comorbidities. Did the patient use the product as taught? If not, what were the barriers and are they surmountable in a way that further study would be valuable. This information will be collected and collated by the phone and patient education questionnaires that will be entered and stored on Qualtrics. Thirdly, are any contraindications to the use of Farrow wraps discovered in this process? Did any patient suffer deleterious effects? If so, why? Was this problem generalizable to others? This will be achieved by paying scrupulous attention to post-operative complications and their genesis within the studied cohort. All post-operative complications will be examined at the monthly Vascular QIT meetings.

### **Dissemination of Findings**

Plans have been made to publish findings in the Journal of Vascular Surgery, a publication which has had a long and productive association with Vascular research derived at Albany Medical Center. This journal routinely publishes articles that are a product of interdisciplinary collaboration or nursing research germane to the improvement of outcomes for patients of vascular surgery. In-person presentation of results will occur at the 2022 annual Society for Vascular Surgery and Society for Vascular Nursing joint symposium. A poster project is planned for submission at Albany Med's Nurse's Week convocation.

### **Application to Nurse Practitioner Practice**

This is a project conceived, developed, and will be implemented by Advance Practice Nurses and Vascular Nurse Practitioners. It is being implemented with the full support of the hospital and the Vascular attending group. Recent restructuring has occurred bringing the

previously private vascular service under the umbrella of Albany Medical Center. This is providing opportunities for greater alignment and cooperation between the inpatient and outpatient clinical settings. This study is the first realization of the benefits of this realignment to provide improved care for our vascular patient population. Additionally, these practice setting changes are allowing nurses on both sides of the provision of care to combine resources to advance study on topics relevant to vascular nursing. We are hoping that the information and experience garnered through this endeavor will encourage further interdisciplinary collaborative efforts and highlight the importance of nursing's contributions in future research opportunities, as well as continue to erode the barriers separating inpatient and outpatient activities.

Recent research has demonstrated the cost benefits of utilizing dedicated Vascular NPs within the clinical setting (Peralta et al., 2020). However, it is found that quantifying the NP's contribution to patient outcomes is invisible in the research (Smigorowsky et al., 2019). This needs to change. Impact of this study to the Vascular Nurse Practitioner practice role will be one of empowerment to affect change within the current system. Until recently, the nurse practitioners at AMC lived in silos that isolated them from one another and directed their activities to task-oriented facets of patient care. The expansion of their role to encourage inquiry in an area of interest with the potential to positively impact patient care has already shown to improve NP satisfaction and role engagement.

From a primary care perspective, peripheral artery disease (PAD) is the third largest contributor to cardiovascular death after myocardial infarction and stroke (Totty et al., 2020). Nurse practitioners, with their emphasis on providing wholistic care, play a vital role in inspiring patients to take steps necessary to protect and preserve their cardiovascular health. For many of these patients, non-compliance occurs because of perceived inability to change their health

status. Nurse practitioners are uniquely positioned to change this perception and prolong states of health in challenged patients such as those receiving specialized vascular care (Lecouturier et al., 2019).

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