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Improving Orthopedic-Related Postoperative Edema Management in a Rehabilitative Nursing Setting

Katie L. Kluga[1,2], DNP, APRN, NP-C, OCN, CHPN, CMSRN, Susan Weber Buchholz[3], PhD, ANP, FAANP & Pamela A. Semanik[3,4,5,6], PhD, MS, APRN

Abstract

Purpose: The aim of the study was to reduce postoperative edema in total knee and hip arthroplasty rehabilitation patients.
Design: A pre– and posttest design was used for this quality improvement project at a rehabilitation facility.
Methods: Staff and patient edema education was standardized. Staff pre- and posttests were administered. Patients were interviewed to assess for knowledge of edema management. Chart audits were assessed for edema management and length of stay.
Findings: Average staff knowledge scores ($n = 50$) increased pre- to posteducational video (64% vs. 70%). Of patients interviewed posteducation ($n = 24$), 38% were able to list two characteristics of edema. Two chart audits completed pre- and posteducation demonstrated that the majority of patients ($n = 30$ per group) had edema upon admission (96% vs. 97%). However, length of stay decreased by 3 days (19.2 vs. 16.3).
Conclusion: Standardized postoperative edema education can improve staff and patient edema knowledge and management.
Clinical Relevance: Edema education is recommended for orthopedic patients in rehabilitation facilities.

Keywords: Arthroplasty; edema; orthopedic; postoperative; rehabilitation.

Introduction

Approximately 52.5 million Americans have been diagnosed with osteoarthritis and 22.7 million experience activity limitations because of this condition (Centers for Disease Control and Prevention, 2014a). Knee and hip joint replacement surgeries are common and effective interventions that can alleviate pain and disability secondary to osteoarthritis (Wallace, Judge, Prieto-Alhambra, de Vries, & Arden, 2014). In 2010, more than one million hip and knee replacements were performed in the United States (Dowsey, Gunn, & Choong, 2014). Estimated costs associated with total knee and hip joint replacement hospitalizations in the United States were $28.5 billion and $13.5 billion, respectively, in 2009 (Centers for Disease Control and Prevention, 2014b). There has been an increased demand for knee replacement because of rising rates of osteoarthritis in the population aged 64 years old and younger (American Academy of Orthopaedic Surgeons, 2014). Demands associated with the aging population also contribute to the rise in related total joint replacement surgeries (Dowsey et al., 2014).

Edema is a common postoperative knee arthroplasty condition that cannot usually be averted (Fu-qiang, Zi-jian, Ke, Huang, & Zhog-jun, 2011), but it can potentially be reduced (Brock, Sprowson, Muller, & Reed, 2015). Pain, swelling, and inflammation in the perioperative tissue area are normally present after knee arthroplasty surgery (Su et al., 2012). Swelling is also noted postoperatively in total hip arthroplasty (THA) patients, particularly in the thigh (Zhao et al., 2014). Knee swelling is most evident 3–5 days postoperatively in total knee arthroplasty (TKA) patients (Fu-qiang et al., 2011) and most evident 7 days postoperatively in THA patients (Holm, Kristensen, Husted, Kehlet, & Bandholm, 2011).

Correspondence: *Katie L. Kluga, 1836 Essex Pl, Downers Grove, IL 60516, USA. E-mail: kkluga@gmail.com*

1 Department of Adult Health and Gerontological Nursing, Rush University College of Nursing, Chicago, IL, USA

2 Department of Adult Health and Gerontological Nursing, Rush University Medical Center, Chicago, IL, USA

3 Department of Adult Health and Gerontological Nursing, Rush University College of Nursing, Chicago, IL, USA

4 Department of Physical Medicine Rehabilitation, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

5 Total Joint Venture, LLC, Chicago, IL, USA

6 Rehabilitation Institute of Chicago, Chicago, IL, USA

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Similar to comparable orthopedic rehabilitation facilities, managing the complication of postoperative edema in TKA and THA patients has been an ongoing challenge at a rehabilitation facility in Chicago, Illinois, for the past 3 years. In a 1-year period, approximately 95% of TKA and 94% of THA patients experienced postoperative soft tissue lower extremity edema. According to internal stakeholders, obesity, perioperative fluid overload, and poor postoperative positioning may contribute to the incidence of postoperative edema that can lead to patient discomfort, altered skin integrity, impaired mobility, and delayed rehabilitation in TKA and THA patients at the facility. Edema management requires a collaborative effort between various clinicians and orthopedic patients.

Although edema management was incorporated into daily rehabilitative care before implementation of this project, a standardized facility edema assessment and management protocol did not exist. Internal stakeholders suggested standardizing staff education regarding edema assessment and management to streamline edema management and improve staff edema knowledge. Nursing staff had limited knowledge and training regarding postsurgical edema management, which further affected optimal patient edema education. The purpose of this project in a rehabilitative nursing facility was to assess and reduce the severity of postoperative edema in TKA and THA patients by (a) standardizing staff education about edema knowledge and assessment, (b) standardizing patient edema knowledge, and (c) auditing staff edema documentation.

Literature Review

Pathophysiology and Management of Edema

Postsurgical swelling typically occurs in both lower limbs; however, operative limb swelling is more significant than nonoperative limb swelling (Fu-qiang et al., 2011). Fluid overload in the perioperative period contributes to fluid imbalance and general swelling postoperatively (Holte, Sharrock, & Kehlet, 2002). Generalized peripheral edema is noted as a common postoperative complication particularly in obese knee and hip arthroplasty patients (Friedman, Hess, Berkowitz, & Homering, 2013) and is normally present in this population because of decreased muscular activity, reduced range of motion, and subsequent venous stasis (Bertelli, de Oliveira, Gimenes, & Moreno, 2013). Vascular injury and intra-articular bleeding in the surrounding joint tissues also contribute to postoperative swelling (Brock et al., 2015), quadriceps muscle weakness (Brock et al., 2015), pain, limited mobility, postponed physical rehabilitation (Fu-qiang et al., 2011), and increased incidence of surgical wound dehiscence and infection (Brock et al., 2015). Reduced functional performance in orthopedic patients related to postoperative lower extremity edema also negatively impacts length of stay and patient perception of surgical outcomes (Brock et al., 2015).

Cryotherapy, graduated compression stockings, pressure bandaging, continuous passive motion, pneumatic compression devices, and manual lymph drainage have been utilized among various studies and institutional protocols to improve patient mobility, function, pain control, swelling, blood loss, and prevention of venous thromboembolism in the immediate postoperative period. Limb elevation, frequent repositioning, sodium restriction, and diuretic use are general edema management techniques also utilized in postoperative orthopedic rehabilitation patients. However, several of these modalities are poorly understood or lack adequate support from the literature.

Cryotherapy or cold application has the potential to reduce pain, swelling, inflammation (Thienpont, 2014), and joint trauma after TKA surgery (Adie, Naylor, & Harris, 2010). Combined cold application and compression may be more effective than ice used separately (Markert, 2011). The current literature contains low-quality evidence regarding the benefit of cryotherapy in postsurgical TKA patients (Adie, Kwan, Naylor, Harris, & Mittal, 2012). However, cryotherapy has little to no side effects, and there is no documentation of therapy-induced hypothermia or delayed wound healing (Parvizi, Miller, & Gandhi, 2011).

Elastic compression stocking therapy can benefit postoperative pain, swelling, and mobility (Munk, Jensen, Andersen, Kehlet, & Hansen, 2013) at minimal risk and cost after TKA surgery (Banerjee et al., 2013). However, no clinical effect was shown with regard to compression bandaging use on postoperative edema, pain, and mobility in TKA patients (Munk et al., 2013). The specific benefits of elastic compression dressings alone may depend on their elasticity, durability, and force of compression (Banerjee et al., 2013). Vascular assessment is necessary in the selection of compression therapy, because it is contraindicated in patients with peripheral artery disease (Cook, 2012). The effectiveness of compression therapy is largely affected by patient compliance (Simon, 2014). Patient complaints of pain and tightness related to compression stocking use can be managed by providing pain medication, correctly applying appropriate sized stockings before getting out of bed in the morning, encouraging the patient to ambulate with the compression stockings, and elevating the legs without removing the compression stockings (Simon, 2014).

Recent literature suggests that continuous passive motion may improve range of motion and quality of life after TKA, but associated outcomes related to edema,

pain, and muscular strength are unclear (Harvey, Brosseau, & Herbert, 2014). Researchers generally concluded that postoperative physiotherapy was more beneficial than combination continuous passive motion physiotherapy (Viswanathan & Kidd, 2010). Several studies cited removal of continuous passive motion protocols from their institution after reviewing the literature and conducting clinical research (Alkire & Swank, 2010; Boese et al., 2014; Herbold et al., 2014; Maniar, Baviskar, Singhi, & Rathi, 2012).

Current evidence is limited with regard to pneumatic compression and manual lymph drainage interventions to reduce edema postoperatively. In the study by Windisch et al. (2011), intermittent compression reduced soft tissue swelling in the thigh and knee, which improved postoperative mobilization, length of stay, and treatment costs for TKA patients. Calf-thigh pneumatic compression was more useful in reducing swelling than plantar compression in postoperative THA patients in a recent Cochrane literature database review (Zhao et al., 2014). However, this information was concluded from a single study that contained weak evidence (Zhao et al., 2014).

Postural drainage and manual lymph drainage are techniques physical therapists can apply that are beneficial to the reduction of posttraumatic edema in obese postoperative patients (Bertelli et al., 2013). Manual lymph drainage may increase knee flexion up to 6 weeks after TKA; however, manual lymph drainage therapy does not improve knee edema (Ebert, Joss, Jardine, & Wood, 2013). The technique of lymphatic drainage requires the use of a specialist practitioner or a clinician with extensive training (Newton, 2011).

Leg elevation, in addition to exercise, can improve venous return, which also reduces swelling (Simon, 2014). Leg elevation is applied in common practice due to the gravitational effects of venous and lymphatic flow in lower extremity limb effusion and edema (Bertelli et al., 2013). Sodium restriction and frequent position changes are also recommended in edema management (Simon, 2014). Prolonged standing and sleeping in a chair should be discouraged to avoid venous pooling and formation of blood clots (Simon, 2014).

Diuretic therapy may also assist with generalized edema management in patients experiencing systematic causes of edema or venous insufficiency (Simon, 2014). However, diuretics should be used with caution in elderly patients or patients with multiple comorbidities (Simon, 2014). Adverse effects including dehydration, electrolyte imbalance, and metabolic disturbances must be considered before selecting diuretic therapy (Simon, 2014). Diuretic use may also contribute to the development of edema, which may require discontinuation of diuretic use for at least 2–3 weeks (Sterns, 2014).

No current studies attempt to address comprehensive, multifaceted edema management protocols for total knee and hip arthroplasty patients involving nursing staff in an orthopedic rehabilitation setting. Therefore, understanding current orthopedic literature involving postoperative edema pathophysiology and management is important in understanding the problem of edema as well as potential interventions that can be used to manage edema in this patient population and setting.

Methods

A quality improvement project was conducted at a rehabilitative nursing facility to standardize edema education, assessment, and management.

Design, Setting, and Sample

A pre and post intervention was used for this quality improvement project. The project was conducted at a mid-sized freestanding rehabilitative nursing facility that provides physical rehabilitation to orthopedic, neurologic, cardiac, and general medicine patients in the Chicago land area. Patients were admitted to this facility from 10 local hospitals or other skilled nursing facilities. This project was primarily conducted on two of the four nursing floors that specialized in orthopedic nursing rehabilitation. Involved staff included registered nurses, licensed practical nurses, certified nursing assistants, restorative aids, and memory support coordinators from the four nursing floors.

Timeline

This project was completed in three time periods, over 20 months. In the 6 months prior to the intervention, 30 patient charts were reviewed to examine patient edema assessment and management. Over the next 7 months, standardized staff and patient education was provided. During this time period, 24 patients were interviewed to determine their edema knowledge. In the 7 months following staff education, 30 patient charts were completed to determine change in edema assessment and management.

Procedure

Standardization of Staff Edema Knowledge and Assessment

Edema education, assessment, and management was standardized for the staff by (a) developing an educational edema video, (b) using an edema checklist, and (c) using an edema measuring guide to standardize communication regarding desired edema management practices. Staff

were initially prompted by leadership through daily staff meetings and electronic mail to complete the online learning module that included a pretest, video, and posttest. The director of nursing and nursing supervisor interacted with the nursing staff through daily meetings and verbal reminders to review the binder information including the (a) edema checklist and (b) edema measurement guide and sign off after viewing. Copies of a staff edema checklist and a pitting edema measuring guide were located in a resource binder in three centralized locations on the two orthopedic floors for staff review. Following staff education interventions, the staff received general feedback 1 and 2 months after project implementation through routine staff meetings held by leadership regarding education completion progress and edema management documentation.

The 20-minute online prerecorded staff edema education computer video included information regarding the etiology of edema, risk factors for postoperative edema, methods to assess and manage edema, and information regarding assessment of deep venous thrombosis and pulmonary embolism from the orthopedic literature, clinical expertise, and organizational structure. A 10-item multiple choice pre- and posttest was given to the staff, before and after staff viewed the educational video once. Test content was based on information in the edema video and the staff edema checklist.

The staff edema checklist included pertinent edema risk factors from the orthopedic literature, clinical expertise, and organizational structure including medical history and medications, as well as edema assessment and management techniques, edema documentation, provider communication, and patient education. The staff edema checklist functioned as a visual aid for staff to check off sequential edema management processes completed to standardize staff edema management processes. Provider education content from the edema checklist included recommendations for staff to contact providers regarding increasing edema, edema complications such as skin weeping, impaired therapy participation, pain, as well as edema intervention orders, and new onset of symptoms concerning for pulmonary embolism and deep venous thrombosis.

Deep venous thrombosis (DVT) is defined as a blood clot that develops in a vein buried deep in the body often occurring in the lower extremity (U.S. National Library of Medicine, 2017). A DVT can depart from a vein in the extremity and travel to the lung, which is called a pulmonary embolism (PE) (U.S. National Library of Medicine, 2017). Although PE is less common than DVT after TKA (2% vs. 40–80%), PE can potentially cause death (He et al., 2014). Joint arthroplasty patients are at increased risk for post-operative DVT and PE due to tissue destruction, surgical strain, limited mobility, and reduced muscular strength (He et al., 2014). DVT and PE assessment in addition to peripheral edema assessment is essential for preventing post-surgical complications in TKA and THA patients in a rehabilitation setting according to internal stakeholders.

The edema checklist content also included recommended edema interventions, which included calf measurement, pitting edema measurement, lower extremity elevation, compression stocking, and ice application. The only edema nursing intervention that required a provider order was for compression stocking application. A number of requests for compression stocking orders were not recorded; therefore, we are unable to determine the impact of nursing education on initiation of this order. A flexible measurement tape was used to measure increased lower extremity calf swelling 10 cm below the tibial tuberosity. Edema measurements were to be completed on the affected extremities every day at 6:00 a.m. by the night shift nursing staff. The edema measurement guide included information on how to also assess and grade 1–4+ lower extremity pitting edema severity.

Standardization of Patient Edema Knowledge

Edema education for TKA and THA patients was standardized through the use of a patient education handout administered to patients on the third day of admission. Although it was communicated to staff that they should give the education handout on the first day of admission, there was not a process in place to ensure that this occurred. The handout was actually administered on the fourth day of admission by the nonstaff clinician after the patient interview. It was verified that all patients had not received the edema education handout prior to the interview. However, patients did receive verbal edema education from staff beginning on the first day of admission that was documented in approximately 7% and 23% of patient charts in the pre- and posteducation groups.

The patient education handout included information regarding the definition of edema, edema risk factors, causes of edema, complications of edema, methods to manage edema, and important postoperative signs and symptoms to report to the managing provider. The edema education handout content had a Flesch–Kincaid grade level of 5.9. The Flesch–Kincaid grade level is determined through the use of a formula that scores reading level of written content using average sentence length and number of syllables per word to quantify reading level (Microsoft, n.d.). A seventh or eighth grade reading level is typically recommended for the construction of health materials to facilitate ease of reading (Medline Plus, 2016). Therefore, the patient education handout reading

level was considered acceptable by internal stakeholders for patient teaching.

Patients were interviewed after the third day of admission to assess for edema knowledge and therapy compliance. The interviews consisted of asking patients about the common causes of postoperative swelling, methods to manage swelling, and if they were able to adhere to rehabilitative therapy regardless of their pain and swelling. Edema education was reviewed during the interview. Patients were given an edema education handout to reinforce learning and an opportunity to ask questions as needed.

Data Collection

Tracking Edema Management and Length of Stay

Data from a weekly chart audit was placed into an Edema Tracking Spreadsheet. An Edema Tracking Spreadsheet was used to collect information on patient demographics (age, gender), type of surgery, health variables (body mass index [BMI], psychological history, Patient Health Questionnaire-Nine[PHQ-9] depression score), edema variables (edema documentation and edema management), and length of stay. The PHQ-9 was utilized by a residential services representative per facility protocol to assess depression severity by asking patients nine questions with individual answers assigned points ranging from 0 to 3 in relation to severity of depressive symptoms, which were added to a total score ranging from 0 to 27 per the U.S. Preventative Services Task Force (2005). Psychological comorbidities and traits are correlated with worsened function, pain, and surgical outcomes most notably in the knee replacement population in comparison to the hip replacement population (Dowsey et al., 2014). Edema severity and the patient's ability to psychologically cope with edema-related adversities greatly influence therapy progression (Su et al., 2012). PHQ-9 scoring data were included as a variable since internal stakeholders noted that depression is often prevalent in postoperative TKA and THA patients, which can negatively impact postoperative rehabilitation. BMI was calculated by a dietician from patient height and weight data, with less than 18.5 kg/m^2 categorized as underweight, 18.5–24.9 kg/m^2 categorized as normal weight, 25–25.9 kg m^2 categorized as overweight, and 30 kg/m^2 or greater categorized as obese as per the National Institutes of Health (n.d.). Lower extremity peripheral edema is noted as a common postoperative complication particularly in obese knee and hip arthroplasty patients (Friedman et al., 2013). BMI data were included as a variable to analyze the prevalence of obesity in this patient population and to observe how BMI affected other data variables, including edema severity and length of stay.

Results

Staff Education Results

Staff (n = 50) completed the online edema education module. The staff was composed of 50% nursing aides, 48% registered nurses, and 2% memory support coordinators. Nonregistered nursing staff were included in the educational component per the chief nursing officer request, which was decided after educational materials were produced. Therefore, educational materials and test content language may not have been developed appropriately for a portion of the learners included. The average percentage of correct answers increased pre- to postedema education, testing for 6 of the 10 questions (see Table 1). There was more than a 20% increase in test answer scores related to questions regarding compression stocking application and diuretic indications as well as 13% increase in the medication side effects question results. The decrease in average correct answers was less than 10% for 4 of 10 questions involving edema interventions, medical causes, and signs of DVT and PE. Overall, pre- to posttest staff scores increased from 64% to 70%.

Patient Education Results

After receiving edema education, 37% of 24 patients interviewed were able to name two characteristics of edema or methods to manage edema; 25% of patients were able to name three without assistance demonstrating that patients benefitted from staff edema education. English was a second language for 20% of patients in the posteducation group; 7% were Spanish speaking. Approximately 17% of edema patient education interviews encountered language barriers. PHQ-9 scoring was significantly higher in the posteducation group (p = .003). Approximately 71% of patients with mild depression

Table 1 Staff pre- and posteducation test

	Preeducation Score (%)	Posteducation Score (%)	Score Change
Compression stocking application	22	43	21
Diuretic indications	51	77	26
Edema documentation	67	72	5
Edema interventions	89	83	6
Edema measurement	47	53	6
Limb elevation	40	47	7
Medical causes	93	91	2
Medication side effects	49	62	13
Signs of DVT	96	91	5
Signs of PE	86	77	9
Total average score	64	70	6

and 57% of patients with moderate to severe depression in the posteducation group were able to name two to three characteristics or methods to manage edema showing that increased depressed severity was possibly related to lower patient knowledge scores. Therefore, depression severity in the posteducation group may have negatively impacted patient learning. Nevertheless, all patients interviewed verbalized that they were able to remain compliant with rehabilitation despite discomfort and impaired mobility experienced secondary to edema.

Patient Demographics, Edema Management, and Length of Stay Results

In the patient groups, one preeducation and one posteducation, the average age was 68.5 and 71.1, respectively (see Table 2). No significant differences were found between the groups regarding gender, type of surgery, BMI, length of stay, and psychiatric or dementia diagnosis. BMI was evaluated because of literature noting that edema is exacerbated in the immediate postoperative period in obese individuals and is a primary complication of surgery as it can lead to the development of venous thromboembolism (Bertelli et al., 2013). Postsurgical complications can impede therapy progress; therefore, length of stay was also evaluated in both pre- and post-education patient groups. BMI decreased by an average of 3 kg, and length of stay decreased by an average of 3 days in the posteducation patient group. Although postsurgical complications were not tracked in this situation, the finding of decreased BMI and length of stay could possibly support the idea that higher BMI may be related to longer length of stay.

With edema grading assessment, mild edema increased whereas 1+ pitting edema decreased in the pre- and posteducation groups following project implementation (see Table 3). This increase in mild edema and decrease in pitting edema severity could be related to increased accuracy in edema assessment or standardization of edema management. With regard to edema management, there was a statistically significant decrease in documentation of ice and compression stocking application for the posteducation group (see Table 3). The decrease in compression stocking and ice application orders may be related to lack of staff reinforcement regarding viewing the edema education checklist, which discussed preferred documentation methods. However, orthopedic provider preference could have also influenced the decrease in compression stocking application orders. Although not statistically significant, ordering and documentation of calf edema measurement trended upward in the posteducation group, whereas length of stay trended downward.

There was an average edema measurement increase of 1.09 cm in the preeducation group (7 patients measured) and 0.48 cm posteducation (14 patients measured), during the first 7 days of rehab stay. Calf edema measurements decreased by an average of 1.79 and 0.90 cm in pre- and posteducation groups from the time period of admission to discharge. Differences in calf edema measurement findings could be attributed to change in sample size. It was noted that edema measurements were initiated more frequently following staff edema education possibly contributing to an increase in sample size.

Discussion

Overall, project stakeholders were able to deliver a standardized staff and patient edema education quality improvement project. The majority of staff and patients received edema education due to stakeholder and staff support of project processes, which appears to be important for the success of quality improvement projects

Table 2 Characteristics of the two patient groups used in the chart audit

	Pre-education Group (n = 30)	Posteducation Group (n = 30)	p
Demographics			
Age in years, $M \pm SD$ (range)	68.5 ± 12.5 (28–89)	71.7 ± 7.9 (52–89)	.223
Gender			.116
Female	25 (83%)	20 (67%)	–
Male	5 (17%)	10 (33%)	–
Surgery			.392
Total knee arthroplasty	20 (67%)	21 (70%)	–
Total hip arthroplasty	10 (33%)	9 (30%)	–
Health variables			
Body mass index (kg/m^2), $M \pm SD$	35.7 ± 7.6	32.2 ± 9.3	.108
Psychiatric diagnosis in medical history	11 (37%)	5 (16%)	.072
Dementia diagnosis in medical history	2 (6%)	0 (0%)	.246
PHQ-9 score, $M \pm SD$	4 ± 2.6	7 ± 4.1	.003

Note. PHQ-9 = Patient Health Questionnaire (9 Depression Questions).

Table 3 Edema characteristics and length of stay

	Patients in Preeducation Group (n = 30)	Patients in Posteducation Group (n = 30)	p
Edema variables			
Presence	25	27	.448
Pitting edema			.718
1+	8	5	–
2+	5	6	–
3+	0	1	–
Edema grading			.518
None	5	3	–
Mild	4	9	–
Moderate	1	0	–
Unknown	7	6	–
Edema management			–
Ice			–
Ordered	16	13	.263
Documented	28	19	.003
Elevation			–
Ordered	3	5	.372
Documented	14	18	.263
Compression			–
Ordered	22	12	.007
Documented	15	12	.046
Calf edema measurement			–
Ordered	7	14	.063
Documented	7	12	.529
Patient education			–
Documented	2	7	.081
Venous Doppler ultrasound			–
Ordered	7	3	.253
Length of stay (average days), $M \pm SD$	19 ± 8.1	16 ± 7.8	.170

involving staff processes. Nursing supervisor and administration assistants were key contributors to project success given their continual rapport and involvement with staff, which would be necessary for implementing similar quality improvement projects in a rehabilitation facility setting.

This quality improvement project contributed to standardizing and improving staff education in a rehabilitation facility. In general, average staff tests scores on edema education increased over time despite the diverse staff group that was tested. Although there was a decrease in 4 of the 10 pre- and posteducation testing question score averages, starting scores were 86% correct or higher, suggesting a possible ceiling effect. Two questions regarding compression stocking application and pillow placement for limb elevation had the lowest average test scores at preeducation testing but did improve at posteducation testing. Low test scores in certain questions could be related to testing content because the content language was not specifically developed considering non-nursing staff or bilingual staff educational needs. However, average posteducation scores were still less than 50% in the two areas of compression stocking application and pillow placement for edema management, suggesting that further education is needed regarding compression stocking application and limb elevation.

The quality improvement project also contributed to standardizing patient education. However, only one in four (25%) of the patients interviewed were able to name three characteristics of patient edema, even after being given patient education, which could have also been negatively influenced by higher depression in the posteducation group. This suggests that there is room for improvement in the provision of patient education. It would be beneficial to begin patient education, distribute patient education handouts, and confirm patient comprehension of edema information on admission. Patients would be interviewed at a later time to better assess the actual impact of staff edema education on patient edema knowledge. Providing patient education through different modes may also be useful, such as using demonstration projects, videos, or pictures appropriate for the patient's native language and health literacy level.

Language barriers prevalent in the posteducation group may have negatively impacted the effectiveness of patient edema education. Patients with language barriers had more difficulty communicating regarding the etiology of their swelling and what they could do to reduce its severity. Professional language interpreter services were not available to assist with patient education and interview methods. Because preeducation patient interviews were not conducted, it is unclear how communication barriers, health literacy, and information recall affected patient outcomes before project implementation. However, it is expected that a patient's postoperative knowledge is a critical part of the rehabilitative experience because it can potentially affect their rehabilitative progress and outcomes. Future quality improvement project work in this area could benefit from assessing health literacy levels as well as providing translators when needed.

It appears that project processes related to staff and patient education resulted in positive outcomes in the two different patient education groups. It was found that risk factors of increased age and PHQ-9 scores did not negatively influence edema outcomes following project implementation. Documented edema was not significantly different between the pre- and posteducation groups of TKA and THA patients. Ice documentation, and compression stocking ordering and documentation were significantly less in the posteducation group. Future project work needs to emphasize the importance of ordering edema management strategies and documenting their results. Although not a significant finding, calf edema measurement

increased in the posteducation group and deserves ongoing emphasis in the future educational program. Importantly, length of stay decreased in the posteducation group. Although this was not a significant finding, the fact that there was a decrease in length of stay is important, with regard to returning patients more quickly to their homes and incurring lower postoperative health costs.

Limitations

Several challenges were encountered in the delivery of this educational project at a rehabilitation facility. Staff experienced challenges finding time to complete educational activities due to competing responsibilities. Different strategies including verbal and electronic mail reminders were needed to increase staff involvement and encourage completion of the edema education. As a result, the initial target of completing the educational process in 2 months took 7 months to complete. Ten out of 60 staff members did not complete the edema education module; therefore, it is difficult to determine whether or not they also contributed to positive edema project outcomes; however, this is a valid possibility. In addition, although the pre- and posteducation staff tests contained information from both the edema video and edema resource binder, stakeholders inadvertently did not include certain information from the edema checklist in the edema video content, which mostly involved staff edema documentation. It is likely that this inadvertent exclusion of edema checklist information in video education limited the impact of the staff education component on edema documentation and management.

The learner audience was very diverse with regard to job status in both staff and patient education groups. Nursing assistants comprised half of the staff enrolled in the learning module. The module material was initially targeted for advanced beginner to proficient registered or licensed practical nurses and, therefore, may not have been at the appropriate level for support staff members. Individual job status education outcomes were not analyzed specifically; however, they may have been negatively impacted by test content educational level. Test question wording also seemed to negatively impact learner response scores. Although the test questions were not from a validated instrument, it is possible that language barriers among the nursing staff could have led to misinterpretation on word choices used in certain test questions. With regard to patient education, given that the majority of patients did not have advanced medical knowledge or previous experience with joint replacement surgery, it is understandable why it might have been challenging for them to spontaneously verbalize edema management information, particularly if English was their second language. Further effort is needed to construct native language educational materials and verbal education to facilitate effective patient learning.

Implications for Nursing Practice

Ideally, we believe that similar quality improvement project processes may be implemented in other nursing rehabilitation facilities to streamline postoperative orthopedic edema management and reduce associated complications using existing clinical and organizational structure and resources. However, it appears that increasing education does not necessarily lead to reduced edema severity. To improve patient outcomes related to standardization of facility protocol, increase edema knowledge for both staff and patients, and reduce edema, it is important to solicit increased project stakeholder involvement and continual feedback between both leadership and nursing staff to control for barriers to edema management and documentation.

Possible barriers to edema management may be related to factors such as time, staff recall, or adequate limb elevation. The majority of edema management methods were initiated by nurse-driven protocol. Therefore, increased staff education and reinforcement of edema management processes ideally would lead to a decrease in edema severity. Increased daily project surveillance and reinforcement through the assignment of nursing staff super-users would be beneficial for promoting increased edema management practices and more consistent provider documentation for similar rehabilitation facility quality improvement projects. Ensuring that educational video content is interchangeable with edema resource binder content to improve staff education and simplify project processes may also lead to more effective project results. Ultimately, implementing an organized and standardized approach to edema management in a rehabilitative setting requires ongoing attention and a working relationship between clinical and management staff that reinforces daily patient care routines and associated evidence-based protocols in order to achieve a common goal of improving care quality and patient outcomes. More specifically, rehabilitation nurses have the ability to directly improve quality patient care by coordinating vital edema management processes and collaborating with other care team members to effectively manage this common postoperative complication.

Conclusions

Using a structured clinical approach involving provider communication, documentation, and patient education,

Key Practice Points

- Postoperative edema negatively impacts patient comfort, rehabilitative progress, and length of stay.
- Standardization of edema education and management leads to reduced edema prevalence and severity.
- Patient edema education is an important component of improving edema management.
- Different types of staff have a role in edema management and need to be included in edema education.

rehabilitation nursing care teams are better prepared to produce positive postoperative rehabilitation outcomes and reduce associated complications. Examining the environmental context, recent scientific literature, and clinical expertise while supporting stakeholder interests contributed to the dynamic nature of this quality improvement project, which is necessary for implementing other future rehabilitation nursing projects in a rehabilitation facility setting. Given that edema is largely prevalent during the postsurgical rehabilitation period, this multifactorial approach may be useful for other mid-sized nursing rehabilitation facilities to improve postoperative edema education and management processes while curtailing potential patient health complications.

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