The Clinical Scholar Model: Evidence-Based Practice at the Bedside

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THE CLINICAL SCHOLAR MODEL: EVIDENCE-BASED PRACTICE AT THE POINT OF CARE

The innovative design of the Clinical Scholar Model\textsuperscript{1} enables nurses to question and reflect on traditional practices at the bedside. Maine Medical Center (MMC), a tertiary care center with more than 600 beds in northern New England, used the model to support staff nurses in developing an evidence-based practice (EBP) culture. The model empowered staff nurses to be curious, reflective, and question traditional practices. The three EBP projects described here evolved from the clinical curiosity of staff nurses. Each of the projects used the Clinical Scholar Model to guide the process of identifying, implementing, and evaluating clinical practice changes and outcomes. These projects illustrate how staff nurses use their critical thinking skills to observe, analyze, and synthesize evidence and determine its applicability to the clinical practice setting.

REDUCING THE LENGTH OF BED REST FOLLOWING A CARDIAC CATHETERIZATION OR PERCUTANEOUS CORONARY INTERVENTION

A core group of cardiology nurses used the Clinical Scholar Model as a framework to identify issues surrounding the optimal duration of bed rest for patients following a cardiac catheterization or percutaneous coronary intervention (PCI). The time the nurses spent on this project and attending the Clinical Scholar Program workshops to guide learning of EBP was supported by the nursing director.

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\textbf{KEYWORDS}

- Evidence-based practice
- Staff nurse
- Clinical scholar
- Clinical scholar model
- Bedside evidence-based practice

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The optimal duration of bed rest following a cardiac catheterization or PCI is not known. Duration of bed rest postprocedure may vary from as little as 2 hours to as much as 12 hours. Maintaining bed rest is an effort to avoid complications at the vascular entry point for the procedure, which usually is the femoral artery and/or vein. Vascular complications range from bleeding at the femoral access site, hematomas of varying sizes, arterial-venous fistula, and pseudoaneurysms.²

Potential discomforts arise for the patient remaining on bed rest for any length of time. These discomforts include inability to flex the leg in the femoral area on the procedural side, head of the bed elevated to only 30°, and log rolling from side to side. Back and leg pain may occur related to the inability to move freely in bed or to have the head of bed elevated. Bed rest also can present problems in urinary elimination because of the change in urination habits. These issues are related significantly to patient and family satisfaction with the hospital stay and to hospitalization costs associated with pain medications, urinary catheters, and nursing care time.

Approximately 2000 patients per year experience a cardiac catheterization or PCI at MMC, and traditionally these patients remained on bed rest for 6 hours. Patients and family are the primary stakeholders in this practice, but other stakeholders include staff nurses, physicians, and nursing administrators. Garnering support from all the stakeholders was an important first step in examining the current practice regarding the duration of bed rest and in exploring the feasibility and safety of decreasing the duration of bed rest to 4 hours. For patients and families, the benefits of reducing the duration of bed rest include early ambulation, a potential decrease in pain medication usage, and adequate elimination.

The nursing staff, as stakeholders in reducing the length of postprocedure bed rest, saw an opportunity to change practice using the latest evidence and as an opportunity to improved documentation. A new postprocedure documentation tool including specific features addressing assessments for the development vascular complications over time was developed to introduce and implement this practice change.

Nursing administrators are involved in examining the feasibility of proposals for practice changes. Presenting the cost benefits of a shorter duration of bed rest to nursing administrators helped gain their support. The potential cost savings would be realized in reduced needs for analgesia and assistive equipment and shorter patient stay.

Gaining support from physician stakeholders involved multiple presentations of the results of synthesized research studies with components that paralleled the practices for these cardiac procedures at MMC. The physicians were especially concerned with the risks of vascular complications. Synthesis of the primary external evidence showed that the duration of bed rest could be reduced without increasing vascular complications.

Search and Analysis of the External Evidence

A literature search was conducted in MEDline and the Cumulative Index of Nursing and Allied Health Literature (CINAHL) using the keywords “cardiac procedures,” “bed rest duration,” “amounts of anticoagulation,” “early ambulation,” “and vascular complications.” Thirty research studies were found; five studies included the variables of interest.

The five studies were critiqued using a research critique table.³ Three of the studies were randomized, controlled trials, and two were quasi-experimental. Variables of interest included bed rest duration of 2 to 6 hours,²⁴⁻⁷ femoral access sheath dwell time of approximately zero to 6 hours following the procedure,²⁴⁻⁷ a femoral sheath size of 6 to 8 F,²⁴⁻⁷
and varying amounts of anticoagulant administered during selected cardiac proce-
dures.\textsuperscript{2,4–7} All studies evaluated were of acceptable quality.

**Synthesizing the Internal and External Evidence**

Following critique of the studies, four tables based on the variables of interest were developed to synthesize and compare the results in each of the five studies. Table 1 is an example of a single synthesis table based on length of bed rest. Each table had the same column headings, and findings were compared with current practices within the institution.

Decreasing the length of bed rest from 6 to 4 hours without increasing vascular complications was the major goal of this evidence-based project. The studies most closely paralleling the practices at MMC were those that compared results in a control group remaining in bed for 6 hours and an interventional group that remained in bed for 4 hours. The other synthesis tables tabulated vascular complications incorporating the other variables of sheath dwell time, sheath size, and anticoagulation.

The rate of vascular complications following a cardiac catheterization or PCI was low at MMC. Events considered as complications included bleeding, hematoma, and arterial-venous fistula developing during sheath removal or at some point during bed rest. These complications were considered as internal evidence in the result of decreasing bed rest from 6 to 4 hours. External evidence\textsuperscript{2,4–7} provided an overall complication rate of 6% related to bleeding and hematoma, higher than the current complication rate MMC.

As key stakeholders in this project, the physicians were concerned about a possible increase in vascular complications. The synthesis tables demonstrating the strength of the evidence for reducing bed rest after sheath removal from 6 hours to 4 hours convinced the physicians that the practice change would not increase the potential for risk or harm. After reviewing the framework of the Clinical Scholar Model, the cardiology team gave the project their support.

A proposal to move ahead with this EBP was drafted. The draft was based on strength of the evidence from the research studies regarding vascular complications following a reduction of bed rest from 6 to 4 hours. The provisions for bed rest were prescribed by physicians through an order set for postcardiac catheterization or PCI care.

**Implementing and Evaluating: A Pilot Study**

A pilot study for bed rest duration was planned to test this practice change and to assess the rate of vascular complications. As bedside clinicians, nursing staff were valuable stakeholders in the implementation and monitoring of this practice change. The cardiac interventional department identified as the pilot unit was a demanding area for nursing care. The nursing staff had been removing femoral access sheaths and establishing hemostasis in the procedural area for the past 5 years and was expert in assessing the presence of vascular complications. Their participation was needed to implement the change and successfully decrease the duration of bed rest.

A postprocedure documentation tool was developed to incorporate assessment of the femoral access site and other components that might potentiate a vascular complication. The first assessment served as a baseline for the access site condition. An area for treatment of a vascular complication was included; the designated methods for achieving hemostasis were manual compression or the use of a mechanical device. Vital signs and further assessments were entered on the documentation tool at regular intervals. The countdown to ambulation began when the femoral access sheath was removed, based on the activated clotting time being within the designated
<table>
<thead>
<tr>
<th>First Author(s)</th>
<th>Sample Research Design</th>
<th>Independent Variable/Intervention</th>
<th>Dependent Variable Outcome</th>
<th>Significant Results</th>
<th>Limitations/Gaps</th>
<th>Generalizability (AHRQ Levels of Evidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vlasic W, et al</td>
<td>Randomized, controlled trial N = 299</td>
<td>BR: 2, 4, or 6 hr</td>
<td>Vascular complications</td>
<td>2-hr group</td>
<td>Trial became unblinded after hemostasis</td>
<td>Yes (A)</td>
</tr>
<tr>
<td></td>
<td>n = 99: 2 hr BR</td>
<td>Major: transfusion, surgical repair, ultrasound guided compression, prolonged hospital stay</td>
<td>3% hematoma</td>
<td>4% rebleeding and surgical repair</td>
<td>4% rebleeding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n = 99: 4 hr BR</td>
<td>Minor: requiring site compression, hematoma &lt; 5 \times 5 \text{ cm}, bleeding (soaking two 4 \times 4 \text{ inch gauzes})</td>
<td>2% rebleeding</td>
<td>2% rebleeding</td>
<td>2% rebleeding</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n = 101: 6 hr BR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keeling A, et al</td>
<td>Randomized, controlled trial N = 71</td>
<td>4 hr of bed rest versus 6 hr of bed rest</td>
<td>Vascular complications</td>
<td>4-hr group</td>
<td>Incomplete data collection because of inability to place patients in the control group: doctors ordered 4 hr of bed rest</td>
<td>Yes (B)</td>
</tr>
<tr>
<td></td>
<td>Experimental group: n = 51: 4 hr BR</td>
<td></td>
<td></td>
<td>98% without complication.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control group: n = 20: 6 hr BR</td>
<td></td>
<td>One patient had a small amount of oozing after multiple procedures and ACT &gt; 200 at the time of sheath pull.</td>
<td>6% hematoma</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3% rebleeding</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>6-hr group</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6% hematoma</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5% hematoma</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2% rebleeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Koch K, et al</td>
<td>Descriptive N = 300 patients</td>
<td>2 hr bed rest</td>
<td>Vascular complications</td>
<td>2-hr group</td>
<td>Patients taking oral anticoagulants or heparin before the procedure were excluded</td>
<td>No (B)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bleeding at ambulation</td>
<td>1.7% bleeding at ambulation</td>
<td></td>
<td>Use of compression bandage</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Late bleeding: ambulation to 48 hr Hematoma &gt; 5 \times 5 \text{ cm}</td>
<td>3% hematoma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arterial-venous fistula Pseudoaneurysm</td>
<td>&gt; 5 \times 5 \text{ cm} No late bleeding</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
N = 830  
n = 420: 4 hr BR  
n = 410: BR overnight  
Control group = Bedrest overnight |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                     | Experimental group = 4 hr of bed rest  
Vascular complications  
Bleeding at ambulation  
Late bleeding:  
ambulation to 48 hr  
Hematoma > 5 × 5 cm  
Arterio-venous fistula  
Pseudoaneurysm |
|                     | 4-hr group:  
2.3% all complications  
4-hr to overnight group:  
2.2% all complications |
|                     | Patients taking oral anticoagulants or heparin before the procedure were excluded  
Non randomized use of compression bandage |

N = 200  
Experimental:  
n = 100: 4 hr BR  
Control:  
n = 100: 6 hr BR |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | Experimental group: 4 hr BR  
Vascular complications  
Rebleeding  
Hematoma  
Arterio-venous fistula  
Pseudoaneurysm  
Limb ischemia  
Thrombosis of femoral artery  
Hematoma:  
Small (< 5 cm)  
Medium (6–10 cm)  
Large (> 10 cm) |
|                        | 4-hr group:  
1% small hematoma  
6-hr group:  
2% rebleeding  
1% pseudoaneurysm |
|                        | After cardiac catheterization,  
79% of patients in the experimental group and 71% of patients in the control group received heparin during the procedure |

**Abbreviations:** ACT, active clotting time; AGCHR, Agency for Health care and Research Quality; BR, bed rest.
The method for compression of the femoral access site following sheath removal was identified on the form. The final assessment was an observation of the femoral access site 15 minutes after initiating activity. Exclusions to ambulation at 4 hours were hypertension, sedation, and the development of bleeding or hematoma during bed rest. The postprocedure documentation tool was used to collect quality improvement data at different points in time as well as to provide assessment guidelines.

One of the goals of this EBP project was the absence of vascular complications when bed rest was reduced. After pilot testing for 6 months, there had been no increase in vascular complications. This outcome was communicated to physicians and nursing through cardiology staff and nursing staff meetings. Order sets for postcardiac procedural care were adapted to reflect the 4 hours of bed rest.

Using the framework of the Clinical Scholar Model as a guide, this nurse workgroup identified a clinical practice issue and the evidence needed to support a successful practice change after PCI. It was estimated that over a 1-month period this change in practice resulted in a saving of 300 hours of nursing time, time that could be spent providing patient education and other nursing care. Audits for the development of vascular complication continue with the postprocedure record.

**Dissemination**

The core group of cardiology nurses involved in this EBP project shared their reflections on the Clinical Scholar Model and this project with their colleagues at the hospital and at national and international research conferences. The practice of reduced bed rest is sustained by the change in order sets and the postprocedure record. Nursing staff directly sustain the practice of reduced bed rest following a cardiac catheterization or PCI through efforts to avoid vascular complications while maintaining patient comfort.

**REDUCING POSTOPERATIVE NAUSEA AND VOMITING IN PATIENTS UNDERGOING OPEN-HEART SURGERY**

The following project illustrates using the Clinical Scholar Model in a different setting at MMC, the cardiothoracic ICU (CTICU). Bedside nurses are astute observers of patients’ experiences and responses in health and illness. As a part of their critical thinking processes, staff nurses continuously ask questions about their practice and reflect on the efficacy of their interventions. The richness of the bedside nursing practice and the questions generated are fertile ground for beginning the process of changing nursing practice based on supporting evidence.

Staff nurses in the CTICU observed that many of their patients experienced postoperative nausea and/or vomiting (PONV) during the recovery period. The nurses questioned the current practice protocol. Some of the questions they asked were

- Is treatment of PONV enough?
- Should we be doing more to prevent PONV?
- Is our current rescue treatment with ondansetron adequate?
- What are the most efficacious pharmacologic measures for prevention and treatment of PONV?
- Are there nonpharmacologic treatments for PONV?

A practice-driven clinical question was formulated: “Is the current protocol we use to treat postoperative nausea and vomiting evidence based?” Three staff nurses formed a core nurse workgroup and explored this question. These nurses already were attending the workshops in the Clinical Scholar Program, and the time they spent at the workshops and working on the project was supported by the CTICU nursing director.
The nurse workgroup began with a search for external evidence. Prevalence studies of PONV in patients undergoing open-heart surgery (OHS) showed that this clinical issue was a common problem in this population. The focus of the search turned to the efficacy of pharmacologic treatment strategies for PONV. The challenges of the search became apparent when simple searches in multiples databases revealed thousands of individual articles on various aspects of treatment and prevention of PONV. In this case, there was substantial external evidence, and the primary challenge was how to sift through and synthesize the information relevant to the clinical question.

The Clinical Scholar workshops supported the nurse workgroup in exploring the literature and learning about the levels of evidence that supported practice change. With a well-designed approach to grading the evidence, it became clear that there were meta-analyses, as well as individual studies, that discussed the treatment and prevention of PONV. Unlike the Agency for Health care and Research Quality level of evidence table used in the previous example, the levels of evidence used to grade the reviewed evidence included well-designed quantitative studies, meta-analyses, qualitative research, quality improvement data, and expert opinion. Additional evidence in the form of consensus clinical guidelines was reviewed by the core nurse workgroup. The use of these broad sources of evidence to examine the clinical question strengthened the basis with which they approached the clinical issue and contributed with an approach that was patient centered.

Recognizing the utility of a guideline in summarizing clinical information, the nurse workgroup identified a clinical guideline that addressed the key issues identified in their meetings. They critiqued the guideline using a framework suggested by Brown and gained insight into an overview of the process for addressing PONV in a clinical setting. The evidence reviewed demonstrated that the process of preventing and treating PONV was well studied and well understood. Risk-assessment studies indicated that patients after OHS were at risk for PONV because of a variety of factors, including the length of the surgery and the use of postoperative narcotics. With use of the guideline, it also became clear that prophylaxis involves treatment of the patient before induction of anesthetic as well as treatment in the postoperative phase. The nurse workgroup realized anesthesiologists would be key stakeholders in the project, and they invited a physician colleague to join the project. The anesthesiologist brought important contributions to the workgroup through his knowledge of individual studies that pertained to the efficacy of steroids for PONV in the OHS population. Another stakeholder who joined the core workgroup was a pharmacist dedicated to the ICU setting; his knowledge of the drug therapies and formulary options at MMC was very helpful. Other key stakeholders included the nursing director of the unit, the CTICU staff nurses who implemented a pilot of the project, the cardiothoracic surgeons, and their physician assistants. Building consensus on recognizing the need for EBP change involved the entire culture of the CTICU.

The nurse workgroup saw that PONV was common in their postoperative patients, so they conducted a preliminary 2-week chart audit on the OHS cases. Using antiemetic usage as a flag for PONV, they noted that 50% of patients required treatment for PONV in the first 3 days after surgery. Quality-improvement audits gathered from patients before discharge indicated that patients reported nausea as a major problem postoperatively. This site-specific internal evidence validated the concerns of the staff nurses and supported the need for further exploration of the clinical question.
The external evidence indicated that prevention of PONV should begin for patients before induction of anesthesia via the administration of dexamethasone. Another prophylactic dose of antiemetic, ondansetron, should be administered in the immediate postoperative period. Further rescue therapy for treatment of breakthrough PONV followed a key principle called “multimodal treatment”: that is, should breakthrough PONV occur, it should be treated with a pharmacologic agent with a mechanism of action different from that of the previously used agents. For this reason, prochlorperazaine was added to the protocol for treatment of breakthrough PONV.

Implementation and Evaluation

Through a review of the evidence and interdisciplinary collaboration with representatives from anesthesia and pharmacy, a new evidence-based protocol was developed for preventing and treating patients experiencing PONV after OHS. Nurses and physicians from the CTICU were invited to review the proposed changes and share their concerns. The proposal for change was submitted to and reviewed by the hospital's institutional review board. Detailed baseline data before protocol implementation provided a basis of comparison for evaluating the protocol’s efficacy. The use of this new protocol and analysis of data before and after protocol implementation showed that patients experienced a significant decrease in the incidence and prevalence of PONV in the CTICU. Implementation of the protocol resulted in a 50% overall reduction in patient episodes of PONV from the day of surgery to 4 days after surgery. The protocol was most effective in reducing PONV on the day of surgery and on postoperative day one. Cost analysis showed that the new protocol did not increase the amount of ondansetron used and provided better patient outcomes.

Dissemination

The nurse workgroup involved in this study shared its findings at the unit and hospital level and at national and international conferences. Along with its findings, it proposed suggestions to enhance project sustainability. These suggestions included embedding the data collection and data analysis of the protocol into systems already in place in the clinical microsystem, thereby enhancing the ability continually to review and improve delivery at the point of care.

The systematic process of studying this clinical question using the Clinical Scholar Model provided these clinical scholars with answers as well as even more questions about the clinical experiences of their patients. The protocol developed was effective in treating early-onset PONV, but after OHS many patients also experience later-onset PONV or PONV that persisted throughout their hospital stay. More research in this area is needed to understand the effectiveness of treatments and interventions. In addition, as new therapies evolve, the evidence supporting practice will change. The challenge for clinical scholars is to review and re-evaluate the evidence as it is disseminated; clinical knowledge is evolving at a pace that brings a wealth of both quantitative and qualitative knowledge to the bedside.

IMPROVING GLYCEMIC CONTROL IN AN OPEN-HEART SURGERY PROGRAM

For several years, the Clinical Scholar Model has been used as a format for identifying an issue, assessing internal and external evidence, synthesizing the evidence, implementing and evaluating a change in practice, and disseminating the results in the step-down (intermediate care) unit for patients after OHS. In addition to dissemination, an interdisciplinary team recently evaluated the sustainability of a practice change and subsequent outcomes. In 2004A the cardiothoracic surgical team at MMC instituted
a continuous insulin infusion (CII) protocol in the OHS population, but adherence to the CII protocol (ie, a blood glucose goal of 110 mg/dL in the ICU patients and 150 mg/dL for patients in the step-down unit) had never been evaluated. Also, it had not been determined whether the rates of deep sternal wound infection (DSWI) had been reduced after implementation of the CII protocol.

**Search and Analysis of the External Evidence**

This protocol was based on the research studies conducted by Furnary,\textsuperscript{16–18} which showed that using a CII for 72 hours postoperatively on all patients undergoing heart surgery reduced DSWI and mortality. Before Furnary’s\textsuperscript{16–18} studies, only diabetics were treated with insulin, and the insulin usually was given subcutaneously. Van Den Berghe’s\textsuperscript{19} research on patients in intensive care concluded that patients who had abnormal glucose tests had a much higher risk of infection and mortality. In addition, in their position statement the American College of Endocrinology\textsuperscript{20} recommended a blood glucose of 110 mg/dL or below be maintained for all patients in surgical intensive care.

**Synthesizing the External and Internal Evidence**

Based on the evidence supporting the use of CII in patients undergoing heart surgery, the cardiothoracic team developed a protocol based on the work of Furnary.\textsuperscript{18} The protocol was developed and initiated in both the CTICU and the step-down unit. The protocol was initiated upon the patient’s arrival at the ICU, and it was continued for 96 hours postoperatively. The nursing staff, the doctors, and the physician assistants received minimal education on the use of the protocol, and the protocol was received with skepticism and uneasiness related to the fear of hypoglycemia. Also, there was no plan for an evaluation of the success or failure of the protocol. The only data point collected was the incidence of DSWI, which remained unchanged at 3%. The clinicians’ prevailing perception was that the use of the CII would guarantee good glucose control. Random checks of glucose levels in the cardiac surgery population showed glucose levels consistently were above 200 mg/dL, levels that were alarming. In addition, the CII protocol was not followed in either the ICU or the step-down unit.

**Implementation and Evaluation**

The initial goal of the glucose project was to determine nurses’ adherence to the CII protocol. The original team members included a staff nurse, a physician assistant, and a physician. As the glycemic control project progressed, other team members were added to obtain their expertise; at various times, the team included a dietician, staff nurses, data analysts, medical students, a clinical nurse specialist, perfusionists, and anesthesiologists.

In the initial glycemic control protocol, the target glucose level was 110 mg/dL or less in the CTICU and 150 mg/dL or less in the step-down unit, based on evidence from the work of Furnary\textsuperscript{16–18} and Van den Berghe.\textsuperscript{19} As part of the ongoing quality improvement program, a data collection tool was developed and approved by the MMC institutional review board that included the name, age, and gender of the patient; the procedure performed; the patient’s height, weight, and fasting blood sugar; diagnosis of diabetes; transfusion of blood products; all glucose recordings; and treatment for 96 hours. Blood product information was collected because there is ongoing evidence that patients undergoing heart surgery who receive blood products are at increased risk for mortality and infection.\textsuperscript{21} Following completion of each phase of the glycemic
control project, the data analyst for the Northern New England Cardiovascular Disease Study Group provided additional information on length of stay, DSWI, and mortality.

Body mass index (BMI) and hemoglobin A1c were added as data points in subsequent phases. BMI is a more definitive measure of obesity than height and weight. Abnormal BMIs in patients correlate with higher glucose levels even when the patients do not have a diagnosis of diabetes. Hemoglobin A1c was added in the preoperative order set for all patients undergoing heart surgery to give the practitioner information about previous control of a patient’s diabetes and/or to indicate a need for further testing for diabetes if the preoperative test was abnormal. In previous studies, the risk for infection was highest in the first 72 hours following surgery. The team decided to collect data on 150 patients, approximately one eighth of the annual adult heart surgery population. A proposal was developed and sent to the institutional review board for review and approval. After approval, data were collected on 157 consecutive patients undergoing heart surgery.

**Evaluation of the Glycemic Control Project: Phase One**

Findings from the first phase showed that the mean glucose levels ranged from 128 to 158 mg/dL in the first 96 hours postoperatively, the CII protocol was stopped prematurely in the first 24 hours postoperatively, and the full CII protocol was not followed. In addition, the DSWI rate during the 3 months of the glycemic study was 3.3%, as compared with a target rate of less than 1%. As a result of these findings, the CII protocol was revised, and intensive education on diabetes and hyperglycemia was presented to the nurses in the critical care and step-down units, the physician assistants, and cardiothoracic physicians. It was hypothesized that education would increase both knowledge and comfort level with the CII protocol. The education was done both formally through short educational sessions and informally through discussions on glucose control and use of the protocol. Education was accomplished by physicians, a physician assistant, a unit-based educator, and a diabetic clinical nurse specialist. Daily discussions with nurses, physicians, and physician assistants focused on efforts for reducing DSWI through the implementation of good glycemic control. This approach with education conducted by a team was successful in reaching coworkers.

**Revisions, Implementation, and Monitoring: Phase Two**

In phase two, the target glucose range for patients in the critical care and the step-down units was increased from 110 mg/dL in the ICU and 150 mg/dL in the step-down unit to 150 mg/dL in both units. This change was made to increase the comfort level of the heart surgery team with a future goal of decreasing the upper limit of glucose to 120 mg/dL.

Many things happened during the second phase of this project. In response to multiple complaints about the three-page length of the CII protocol, three medical students developed a nomogram. This user-friendly, color-coded one-page format was well received by nurses, physician assistants, and doctors and has continued to be used with minor changes based on the findings during the subsequent phases of the glycemic control project. During this second phase, patients remained on the CII protocol for 96 hours. Phase two mean glucose levels from admission to the operating room to 96 hours postoperatively were found to be in the range of 124 to 140 mg/dL. No DSWI occurred during 6 months. One of the findings from phase two was the number of abnormal glucose levels in both the known and unknown diabetic population at the 96-hour mark: 25% of the patients were prediabetic or new type 2 diabetics with previously undiagnosed diabetes. This finding created
a new dilemma, because most of these patients would be discharged within 24 to 48 hours.

**A New Dilemma With a Creative Solution**

There were ongoing discussions among physicians, nurses, and physician assistants about how to solve the new problems that arose from the findings in the glucose study. As a result, a team met with to find a solution that (1) would not increase length of stay but would provide a safety net for the patient and (2) would not increase the workload of the staff nurse. A collaborative team including dieticians, dietary aides, nurses, physicians, a diabetic nurse specialist, Lifescan representatives, a laboratory representative, and physician assistants convened to look at both the dietary and discharge needs of the patients. Providing more dietary options for patients and providing new diabetics with a free glucometer and educational materials were two of the decisions made by this collaborative group. In addition, information about poorly controlled diabetics and new diabetics was sent to the patients’ primary care physicians.

**Revisions, Implementation, and Monitoring: Phase Three**

Following minor revisions in the nomogram for the CII protocol and the development of an insulin infusion start chart to differentiate dose amounts depending on a patient’s blood glucose nadir, phase three of the glucose project was conducted. In addition to determining compliance with the CII protocol, data for the discharge plan were collected for the newly diagnosed and poorly controlled diabetics.

During phase three data collection, the cardiothoracic team found several alarming issues:

1. An increase in leg infections
2. No change in mediastinitis or mortality rates
3. Lack of standardization for patients transitioning off the CII protocol
4. Several incidences of hypoglycemia in discharged patients, with one patient readmitted to the hospital with seizures

These findings led to three changes: re-education of nurses about the importance of glucose control, development of a transition protocol to be used when the CII protocol is discontinued, and a preoperative order for hemoglobin A1c for all patients undergoing cardiac surgery.

Changes in practice were made within 1 month. Delays in surgery that occurred because of double-digit hemoglobin A1c and abnormal glucose levels resulted in patients being treated aggressively to bring glucose levels down to a normal level before surgery. Based on the results from Funary’s research,16–18 the risk for DSWI from hyperglycemia diminished by postoperative day three. Because of these findings at the end of phase three of the study, the team decided to discontinue the CII protocol on the morning of postoperative day three.

**Plans for Phase Four**

Funary22 used a CII tight glycemic protocol in the first 72 hours postoperatively when patients were at highest risk for DSWI. Based on Funary’s findings, the team decided to discontinue the CII protocol on the morning of postoperative day three. A transition protocol was developed for use when the CII protocol was discontinued: to standardize the approach for glucose levels above 150 mg/dL, short-acting insulin was administered subcutaneously for correctional coverage. In addition, patients who had a previous diagnosis of diabetes resumed their preoperative regimen on the evening
of postoperative day two or on the morning of postoperative day three. The exceptions to this approach were patients who were taking Metformin HCl and had an elevated creatinine level, diabetic patients who were poorly controlled, and newly diagnosed diabetics. The transition protocol will be evaluated in phase four of the hyperglycemia project.

The cardiothoracic team is aware that ongoing assessment of the CII protocol is needed to reduce each patient’s risk for mortality and morbidity following cardiac surgery. In addition to reducing the DSWI rate, the team has developed a consistent approach for glycemic control in the heart surgery population.

**Interdisciplinary Respect and Collaboration**

The greatest accomplishment to date has been the collaboration among all team members in identifying problems or issues involving the cardiothoracic population. This interdisciplinary team allows all voices to be heard in a nonpunitive atmosphere. This collaborative model has thrived and been sustained for 3 years with the ultimate goal of providing patients with best possible outcomes. The same collaborative approach has been used to implement oral care, prevent pressure ulcers, improve wound care, and develop a ventricular assist device protocol. Informal bi-weekly 30-minute meetings are held to identify any issues within the cardiothoracic patient population and/or issues with staff relationships. Doctors, nurses, physician assistants, management, nursing assistants, and other disciplines are invited to attend. The relationship among the team members filters to the daily work environment, where communication is key to providing the best possible outcomes for patients. Opinions about a patient’s condition are heard, and complications are averted because of this unique model. This collaborative model now is being used to implement glycemic control in all inpatient areas throughout the hospital.

**SUMMARY**

Using the Clinical Scholar Model, staff nurses can evaluate the evidence supporting clinical practice at the point of care. Following the model through the steps was easy for a novice bedside researcher. This model gave clinical staff nurses an avenue for conducting nursing research and implementing evidence-based changes that are meaningful in their daily practice. In addition, the process increased collaborative conversations among health care providers, patients, and families about evidence-based care.

The Clinical Scholar Model serves as an effective guide for investigating and implementing EBP change at the bedside. It assists in identifying problems and issues, the key stakeholders, and the need for change in practice. These three projects, although identifying different clinical issues, followed the format of the Clinical Scholar Model. The completed projects improved patient outcomes. These projects illustrate some real-life examples of bringing this process to the clinical setting and of using the Clinical Scholar Model in practice.

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