Washington State Hospital Association
Partnership for Patients

Preventing Surgical Site Infections
September 22, 2016

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Senior Director, Patient Safety
48,973 fewer harm events!  $607 million savings!
WSHA’s Plan to Reduce SSI

Raising All Boats
- In-person learning sessions and webinars.
- Safety Action Bundles.
- Individual hospital check-ins.

Understanding Data
- Focus Safe Table training on patient populations where surgical infections are higher.
- Discussion on what hospitals found on deep dives in the data and sharing successful practice strategies between hospitals.

Transparency
- Monthly/Quarterly data submission.
- Quarterly results posted on public transparency web site at http://www.wahospitalquality.org/

Activating Patients
- Create patient information guides to inform patients of what they can do to be safe.
Safe Table Learning Collaboratives

Significant progress was made in reducing the infections related to **cardiac**, **orthopedic** and **hysterectomy** procedures through the sharing of best practices among HEN hospitals as well as bringing in content experts from other states and locally.

**Partners** have included:

- Surgical Care and Outcomes Assessment Project (SCOAP)
- Strong for Surgery and
- Quality Improvement Organization (QIO) Qualis Health.
High Impact Actions

• In-person and web training provided.

• Focused on medical evidence and best practices by hospitals showing good results for SSI reduction.
High Impact Actions

Topics that were discussed included:
- Importance of using surgical check lists.
- Compliance with SCIP measures.
- Strategies for obese patients.
- Engaging patients in their care.
- Hand hygiene compliance.
- Sterilization of equipment.

*Peri-Operative Glycemic Control.*
Surgical Site Infections

Surgical site infections (SSI) are the second most common healthcare associated infection, around 290,000 per year. SSIs are associated with significant patient morbidity and mortality. Obesity and diabetes have significant impact on patient outcomes for surgery.

- In 2010, it was determined approximately 36% of U.S population had a BMI 30-40, obesity range.
Sharing Best Practices and Toolkits

Perioperative Glucose Control

Qualis Health, Strong for Surgery & WSHA

2014 Perioperative Glucose Control Best Practices

Acknowledgements: will list names of all persons and hospitals involved in meetings

Preoperative Period
In the weeks prior to surgery and on the morning of surgery

1.1 Preoperative Screening (prior to day of surgery)
   1.1.a Check A1c in all patients with known diabetes within 90 days of surgery
   1.1.b Patients with an A1c of greater than 8.5 may benefit from further evaluation prior to elective surgery.
       A1c threshold alone should not be used to determine if a patient can proceed to surgery
   1.1.c Consider checking fasting glucose or A1c in all patients at risk for diabetes or pre-diabetes (i.e. those with BMI ≥ 30, those ≥ 45 years old)

1.2 Day of Surgery Monitoring
   1.2.a Check glucose on all patients with known diabetes on arrival the day of surgery.
   1.2.b Check glucose on those at risk for perioperative hyperglycemia on arrival the day of surgery. BMI ≥ 30 or those ≥ 45 years old)
31% reduction in Surgical Site infections (Cardiac).

51 fewer patients experiencing cardiac surgical site infections, saving $1.1 million.
34.4% reduction in Surgical Site infections (Total Hip) rate.
Surgical Site Infection (SSI)-Total Knee

42.6% reduction in Surgical Site infections (Total Knee).

134 fewer patients experiencing total knee SSI, saving $2.8 million.

Definition: Centers for Disease Control and Prevention’s (CDC) National Healthcare Safety Network (NHSN), SSI per 100 operative procedures (Cardiac surgery, Coronary artery bypass graft with both chest and donor site incisions [CBGB], Coronary artery bypass graft with chest incision only [CBGC], Colon, Hip prosthesis, Knee prosthesis, Abdominal hysterectomy).

Data Source: CDC NHSN.
16.2% reduction in Surgical Site infections (Abdominal Hysterectomy).

89 fewer patients experiencing abdominal hysterectomy surgical site infections, saving $1.9 million.
16.7% reduction in Surgical Site infections (Colon).

62 fewer patients experiencing colon surgical site infections, saving $1.3 million.
Patients want to know that when they have surgery, they will be safe from infection.
Surgical Site Infections

• In the US, an individual who undergoes a major operation carries a **2% to 5%** risk of surgical site infection. Approximately 160,000–300,000 SSIs occur each year in the United States. This rate is substantially higher if the patient undergoes colorectal surgery, with reported rates of **5% to 30%**.

• For **colorectal surgery** patients:
  – The 30-day readmission rate is **11.4%**;
  – The 90-day readmission rate is **23.3%**;
  – The 30-day SSI rate is **18.8%**;
  – The mean readmission length of stay was **8 days**; and
  – The median cost for an SSI readmission was **$12,835**.

• Patients with an SSI have a 2–11 times higher risk of death compared with operative patients without an SSI.
Impact of Poor Glucose Control

- Science shows that mortality rates double in surgical patients with high glucose levels.
- Thirty percent of patients that have high glucose are not diagnosed as diabetic.
- Maintaining glucose control in patients having general surgery saves lives and reduces complications.
Perioperative Glucose Control

- 1,000 cardiothoracic surgery patients.
- Diabetics and non-diabetics with hyperglycemia.

Patients with a blood sugar > 300 mg/dL during or within 48 hours of surgery had more than 3X the likelihood of a wound infection!


**TABLE 3**
Glucose Levels Among 72 Cases With Surgical-Site Infections and 902 Controls Without Surgical-Site Infections

<table>
<thead>
<tr>
<th>Glucose (mg/dL)</th>
<th>Cases (%)</th>
<th>Controls (%)</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;200 (referent)</td>
<td>35 (49)</td>
<td>651 (72)</td>
<td>1.00</td>
</tr>
<tr>
<td>200-249</td>
<td>21 (29)</td>
<td>154 (17)</td>
<td>2.54</td>
</tr>
<tr>
<td>250-299</td>
<td>11 (15)</td>
<td>69 (8)</td>
<td>2.97</td>
</tr>
<tr>
<td>≥300</td>
<td>5 (7)</td>
<td>28 (3)</td>
<td>3.32</td>
</tr>
</tbody>
</table>

Abbreviation: OR, odds ratio.
Chi-square for linear trend=16.375, P<.0001.
Glucose Control and SSIs
After Median Sternotomy

Hyperglycemia in Non-Diabetic patients was more dangerous than hyperglycemia in diabetics!
Composite Infection
Hyperglycemia vs No Hyperglycemia
All Patients

Glucose in Non Diabetics having Colectomy at Cleveland Clinic

<table>
<thead>
<tr>
<th>Highest Glucose</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 125 mg%</td>
<td>816 (33%)</td>
</tr>
<tr>
<td>126-200 mg%</td>
<td>1289 (53%)</td>
</tr>
<tr>
<td>200 mg%</td>
<td>342 (14%)</td>
</tr>
<tr>
<td>All patients</td>
<td>2447 (100%)</td>
</tr>
</tbody>
</table>

67% or 2/3 of Non-Diabetic Colorectal Surgery patients experienced Hyperglycemia.

Glucose in Non-Diabetics having Colectomy at Cleveland Clinic

Per Cent incidence

* p<0.03, ‡ p<0.01, + p<0.05

Glucose Control

Proven important for SSI risk:

- Cardiac surgery
- General surgery
- Colorectal surgery
- Vascular surgery
- Breast surgery
- Gynecologic Oncology surgery
- Hepato-pancreatico-biliary surgery
- Orthopedic surgery
- Trauma surgery
Regardless of the Diagnosis of Diabetes (or not)
Hyperglycemia Increases

Morbidity
Mortality
Length of Stay
Glucose Levels and SSI

• The exact “best” level of glucose control in the perioperative period is not known.
  • **160** is what WSHA and SSI Colon Collaborative are advocating.

• High glucose levels unequivocally increase the risk of SSI and other perioperative infections.

• Tight glucose control in the perioperative period is tricky.

• Hypoglycemia is a concern which can increase the risk of morbidity and mortality.
SSI Colon toolkit

Preventing Surgical Site Infections--Colon: Toolkit®

Acknowledgements

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- PeaceHealth Southwest Medical Center
- PeaceHealth St. Joseph Medical Center
- Providence St. Mary Medical Center
- Pullman Regional Hospital
- Qualis Health
- Seattle Children’s Hospital
- Skagit Valley Hospital
- Swedish First Hill
- UW Medical Center
- UW Medicines Harborview Medical Center
- UW Medicine Valley Medical Center
## Measures of Success

<table>
<thead>
<tr>
<th><strong>Prevention of hyperglycemia</strong></th>
<th>Percent of surgical cases maintaining glycemic control (≤ 160mg/dL).</th>
<th>Total number of surgical cases maintaining glycemic control (≤ 160mg/dL).</th>
<th>Total number of specific operative procedures.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Treatment of hyperglycemia</strong></td>
<td>Percent of surgical cases in which an intravenous insulin infusion was initiated for any patient with a blood sugar ≥160mg/dL.</td>
<td>Total number of surgical cases in which the patient had a blood sugar ≥160mg/dL and an intravenous insulin infusion was initiated.</td>
<td>Total number of specific operative procedures in which the patient had a blood sugar ≥160mg/dL and an intravenous insulin infusion was indicated.</td>
</tr>
</tbody>
</table>

Pre-Operative Screening and Identification of Patients at Risk for Hyperglycemia

- Hyperglycemia may be the most important risk factor for SSI.
- Early glycemic control should reduce the incidence of SSI.
- Monitor blood glucose level one hour after initial incision and maintain level $< 160 \text{ mg/dl}$ on the day of surgery and throughout the postoperative period.
Interventions

- Engage with out-patient clinics and physician offices to coordinate assessment of risk for perioperative hyperglycemia.
- Select a risk assessment tool and implement consistently for diabetics and non-diabetics.
- Identify known diabetics and patients who could potentially experience hyperglycemia pre-operatively.
Interventions

• Establish glucose control protocols for use throughout perioperative process. There are various algorithms available.
  • Select and implement an effective, evidence-based glucose control protocol once buy-in is obtained by physicians, nurses and administrators.
• Work with primary care physician, endocrinologist and/or hospital glycemic control team to reduce HbA-1C for known diabetics. HbA-1C does not predict infection if intraoperative hyperglycemia is controlled.
  • If patient has a high HbA-1C, the patient is more prone to perioperative hyperglycemia, deserves more attention and needs vigorous attempts at controlling glucose.
**Strong for Surgery** is an initiative aimed at disseminating best practices to improve clinical outcomes and prevent infections.

One of the **Strong for Surgery** approaches is to screen a patient’s blood sugar status prior to surgery and intervene as appropriate to promote healing. Having control of blood glucose prior to surgery lessens the chance of hyperglycemia or hypoglycemia during and after the operation or procedure.
Glucose Control Algorithms

• The Rabbit 2 basal bolus protocol is online at 

• The Society of Hospital Medicine Glycemic Control Resource room contains links to multiple insulin infusion protocols at 
  http://www.hospitalmedicine.org/ResourceRoomRedesign/html/12Clinical_Tools/04_Insulin_OrdersIV.cfm
University of Washington Medical Center Example of Operating Room and Pre-Op Holding Insulin Infusion Protocol Orders.
University of Washington Medical Center Example of HIGH DOSE Insulin Infusion Protocol Orders.
Pre-Operative Nutritional Enhancement

• A patient’s nutritional status significantly impacts surgical outcomes, especially those patients deemed high risk, such as diabetics and malnourished individuals.

• The *Enhanced Recovery after Surgery* (ERAS) protocol consists of multiple evidence-based interventions designed to promote early recovery for patients after surgery and without complications. Surgery can disrupt physiologic and metabolic homeostasis due to stress resulting in an endocrine response and increased post-operative complications.
Pre-Operative Nutritional Enhancement

- By using the ERAS pathway, it has been demonstrated patients’ length of stay was reduced by 30% and post-operative complications reduced by up to 50%.
- Pre-operative oral carbohydrate loading in lieu of traditional fasting after midnight has been shown to raise *insulin sensitivity* by 50% and the effect continues through the post-operative period resulting in 50% less *insulin resistance*.
- There is less risk of hyperglycemia and improved retention of protein for healing purposes.
Interventions

• Engage with out-patient clinics and physician offices to coordinate pre-operative nutritional screening of patients.

• Select a nutritional screening tool and implement consistently for all pre-surgical patients.

• Important considerations in determining whether a patient is at risk for malnutrition include a Body Mass Index (BMI) less than 19, low albumin, unintended weight loss, decreased appetite and inability to tolerate food intake.
One of the Strong for Surgery approaches is to screen a patient’s nutritional status prior to surgery and intervene as appropriate to promote healing. There is evidence which demonstrated the use of “arginine supplemented diets” was associated with a 41% reduction in risk of infectious complications.
Interventions

• Beginning **5-6 days** pre-operatively, provide at-risk patients with a pre-op nutritional supplement containing arginine, Omega 3 fatty acids and nucleotides to strengthen a patient’s immune response and prevent infections.

• Give colorectal surgery patients a carbohydrate-rich clear liquid beverage 2 hours before surgery to reduce pre-operative thirst, dehydration, hunger, anxiety, nausea and **hyperglycemia**.

• The ASA has approved the intake of clear liquids up to 2 hours before elective procedures requiring anesthesia.
Intra-Operative Glycemic Control

• Hyperglycemia significantly increases
  1. the risk of infection,
  2. re-operative interventions and
  3. death in patients with or without diabetes.

• Achieving euglycemia in colorectal surgical patients requires collaboration amongst surgeons, anesthesiologists, endocrinologists, hospitalists, pharmacy, unit nurses and nurse diabetes educators.
Intra-Operative Glycemic Control

• The precise best target of glucose control is not known.
• Different institutions reach different conclusions, however, a lower value is always better, as long as hypoglycemia is avoided.
• It is important for the perioperative team to have a target it is working towards for these patients.
Interventions

• Develop a multidisciplinary glycemic work group that will support the development and implementation of perioperative glycemic control and insulin infusion protocols.
• Consider giving a complex carbohydrate drink 2-3 hours before the operation to increase insulin sensitivity.
• Maintain a glucometer on every anesthesia station and to have blood glucose data automatically download into the Electronic Medical Record (EMR) for ease of monitoring and analysis by anesthesia providers.
• Check blood glucose when patient arrives in Pre Op holding.
SCOAP Surgical Checklist

2 Before incision: Process control

- Attending Surgeon reviews: (as applicable)
  - Attending Surgeon not present for SCOAP 1? Repeat SCOAP 1.
  - Each person introduces self by name & role
  - Personnel exchanges: timing, plan for announcing changes
  - Essential imaging displayed; right & left confirmed
  - Has patient positioning changed since SCOAP 1? Is marking still visible?
  - Antibiotic prophylaxis - drug, dose, time, redosing plan
  - Active warming – needed? In place, turned on?
  - Risk of hyperglycemia? Plan for insulin protocol if needed
- Sharps management plan
- Specialty-specific checklist

4 After skin closure complete: No retained objects, debriefing, care transition

- All Team Members (Attending Surgeon or designee leads):
  - Confirm final needles/ sponges/ instruments count correct
  - Surgeon views all sponges & laps in holders
  - Confirm name of procedure
  - Any specimens? Confirm label & instructions
  - Equipment issues to be addressed? If yes, response plan
  - Other issues? If yes, response plan

- Surgeon and Anesthesia:
  - Does patient need special monitoring?
  - Insulin drip needed?
  - Post-op beta blockers needed?
  - Post-op anticoagulation needed?
  - Pain management by Surgery or Acute Pain Service?
  - Other special concerns for patient recovery?
Interventions

- Ensure frequent monitoring of blood glucose, such as hourly, on all patients, both known diabetics and non-diabetics, in the OR.
- Institute glucose management protocol (e.g. Basal bolus or standard protocol intravenous insulin delivery for blood glucose > 160 mg/dl at any time in the perioperative period).
- Explore incorporating insulin protocols into Computerized Provider Order Entry (CPOE) and the EMR to support decision making in a reliable manner.
Strategies

Partnerships: Hospitals, Physicians, Nurses and Pharmacists

**2014 Perioperative Glucose Control Best Practices**

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**Preoperative Period**
- In the weeks prior to surgery and on the morning of surgery
  1.1 Preoperative Screening (prior to day of surgery)
    - 1.1.1 Check A1C in all patients with known diabetes within 90 days of surgery
    - 1.1.2 Patients with an A1C of greater than 8.5 may benefit from further evaluation prior to elective surgery. A1C threshold alone should not be used to determine if a patient can proceed to surgery.
    - 1.1.3 Consider checking fasting glucose or A1C in all patients at risk for diabetes or prediabetes (i.e., those with BMI ≥ 30, those ≥45 years old)
  1.2 Day of Surgery Monitoring
    - 1.2.1 Check glucose on all patients with known diabetes on arrival the day of surgery.
    - 1.2.2 Check glucose on those at risk for perioperative hyperglycemia on arrival the day of surgery. BMI ≥ 30 or those ≥45 years old.
  1.3 Glucose Target
    - 1.3.1 Glucose on arrival of the day of surgery is <180mg/dL
    - 1.3.2 Glucose ≥180mg/dL alone is not a reason to cancel surgery; rather develop an institution protocol on how to monitor and manage glucose perioperatively for patients ≥180mg/dL
    - 1.3.3 If acidemia or hyperosmolar in the setting of hyperglycemia, do NOT proceed with surgery unless urgent/emergent
  1.4 Intervention
    - 1.4.1 Institutions should develop protocols for action for patients with glucose ≥180mg/dL.

**Reduction of Surgical Site Infections: Glucose Control Toolkit August 2016**

“Health Care without Complications”

Surgical Glucose Control for all patients during pre, intra, post and discharge period
Sharing Best Practices and Toolkits

Reduction of Surgical Site Infections: Glucose Control Toolkit

Key to Success

- Engage and educate clinicians on importance of managing glucose in both diabetic and non-diabetic patients having surgery.
- Start with one type of surgery such as colorectal and then spread to other surgeries.
- Ensure glucose is in good control prior to arrival for surgery. (Strong for Surgery)
- Implement policies, procedures, and order sets to identify and treat blood glucose levels greater than 180 mg/dl in the perioperative period.
- Monitor surgical site infection data and blood glucose data to evaluate compliance with these practices. Discuss in forums from board to unit based meetings.
Post-Operative
Maintain Glycemic Control

• Maintain blood glucose level < 160 mg/dl on the day of surgery and throughout the postoperative period.
Interventions

• Frequent monitoring of blood glucose (all patients, both known *diabetics* and *non-diabetics*) beginning in the PACU, and on all patient care units.

• Institute glucose management protocol (e.g. Basal bolus or standard protocol insulin delivery for blood glucose > 160 mg/dl.)

• When evaluating resources, nurses, and investments required on the patient care units to safely administer insulin infusions to postsurgical patients, carefully consider and evaluate substantial costs to be saved by the prevention of SSIs and other complications.
Success Can be Achieved Through

- Leadership by:
  - Physician
  - Pharmacist
  - Nursing
Step 1: Engage
- Assemble steering team
- Tell a story
- Share data
- Identify which surgical population will be the first implemented

Step 2: Implement Policies, Procedures, and Order Sets
- Adopt policy, procedure, and order sets to identify and treat with insulin blood glucose greater than 180 mg/dl.
- Support with glucose control prior to arrival for surgery.
  http://www.becertain.org/strong_for_surgery

Step 3: Training and Education
- Educate staff and physicians.
- Board members and c-suite leaders.

Step 4: Evaluate Success:
- Monitor monthly colorectal and other surgical infection rates using the existing data your hospital reports to the Center for Disease Control and Prevention (CDC).
- Collect and report blood glucose greater than 180 mg/dl anytime pre-operatively and during the first two days post-op.
- Share data monthly with forums at all levels from the board to nursing units.

Step 5: Hardwire
- Collect staff input to evaluate need for changes in the process
- Celebrate successes.
- Spread to other surgeries.
Questions?

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