How to Predict Groin Wound Infections After Open Vascular Surgery: What Can Be Done to Prevent Them?

Cynthia E. K. Shortell, MD
Kyla M. Bennett, MD
Duke University Medical Center
Durham, North Carolina

VEITH Symposium
November 20, 2015

Disclosures

▪ None

The Problem....

▪ Groin wound infection is a common complication of LE bypass: 6.4-38.5%

▪ Associated with increased risk of morbidity, LOS, graft infection, graft loss, and amputation

Some solutions...

▪ CHG wipes and chlorhexidine prep

▪ Limiting OR traffic

▪ Reducing patient risk factors (HgA1C, smoking, nutrition)

▪ Prophylactic flap coverage

Prophylactic Groin Flaps

▪ Promising tool to reduce groin wound infection

▪ Not appropriate for all patients
  ▪ Adds recovery time
  ▪ Cost
  ▪ Potential for increased complications
  ▪ Adds complexity for redo

▪ How to predict who will benefit?
Predicting groin wound infection

- Many studies looking at overall SSI in VS
- Only one has attempted to stratify patients at increased risk
- None validated

Study objectives

- Part 1: Identify factors for severe groin wound infection (SGWI) requiring reoperation
- Part 2: Using information from Part 1, create validated predictive model for SGWI
- Part 3: Create simple online scoring app

Methods

- All patients at our institution undergoing revasc for occlusive disease involving a groin wound 2009-2012
- Primary outcome was SGWI (reoperation involving infection as indication)

Statistical Analysis

- Potential predictors
  - Age
  - Gender
  - Surgeon
  - BMI
  - Smoking status
  - DM
  - ESRD
  - Malnutrition
  - Prior groin incision
  - Open wound/tissue loss
  - Conduit
  - Target outflow vessel
  - Urgency of procedure

- Patients randomly assigned to one of two groups:
  - Test group, which was used to develop a predictive model for our primary outcome
  - and a validation group, which was used to test that model

- The primary outcome is SGWI
- Multimodel inference methods used to evaluate all possible combinations, interactions, and transformations of potential predictor variables from the test group of patients
- The resulting model that exhibited the lowest Akaike information criterion was then selected for testing with the validation group of patients

Results

- Total of 284 pts available for analysis
- 140 test group, 144 validation group
Results

17 (12.1%) of patients in the test group developed SGWI

Results

Table II. Comparison of preoperative patient characteristics in the test and validation groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Test Group</th>
<th>Validation Group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>68.9 ± 15.8</td>
<td>70.2 ± 15.5</td>
<td>0.12</td>
</tr>
<tr>
<td>Gender (male)</td>
<td>72 (65.8%)</td>
<td>120 (66.7%)</td>
<td>0.78</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.9 ± 4.8</td>
<td>27.2 ± 4.4</td>
<td>0.32</td>
</tr>
<tr>
<td>ESRD</td>
<td>12 (10.6%)</td>
<td>18 (10.4%)</td>
<td>0.89</td>
</tr>
<tr>
<td>Malnutrition</td>
<td>6 (5.3%)</td>
<td>10 (5.7%)</td>
<td>0.73</td>
</tr>
<tr>
<td>Urgent Procedure</td>
<td>12 (10.6%)</td>
<td>20 (11.5%)</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Accuracy of the model was 88.6%*

Application for our model

Fig. Screenshot of simple, 12-variable application to determine a patient's risk of developing postoperative groin wound infection.

Summary and Conclusions

- Our cross-validated model to predict groin wound infection identifies prior groin incision, female gender, BMI, ESRD, malnutrition and urgent/emergent procedure as high risk variables.
- Using this information, surgeons may choose to deploy aggressive measures such as prophylactic groin flaps to prevent GSWI.

Thank you
Statistical analysis

After stratification by year and vascular surgeon, all patients who qualified for inclusion in our study were randomly assigned to two groups (test group and validation group) to enable twofold cross-validation of our predictive model. The purposes of this cross-validation procedure were to reduce the potential impact of model overfitting and to assess how our predictive model would generalize to an independent data set. More extensive partitioning of our patient sample was not possible because of the relatively small sample size. The patient and procedure characteristics of test group patients with and without operative groin wound infection were compared by Pearson χ² tests, Student t-tests, and univariate logistic regression as appropriate. We next used a best-fit method of multivariable logistic regression model selection for patients from the test group to identify the ideal predictive model for operative groin wound infection suggested by our data. This is an iterative process that includes all available predictor variables without regard to their univariate association with the outcome of interest and that tests all combinations of predictor variables, including interactions and variable transformations, and selects the model that has the lowest Akaiki information criterion as the best-fit model for the available data from the test group of patients.

We then tested this model using patients from the validation patient group to assess the accuracy of our predictive model. Discrimination was determined as the area under the receiver operating characteristic curve for the model, calibration was determined using the Hosmer-Lemeshow statistics, and accuracy was defined as the number of patients in the test or validation data sets who were correctly classified as developing or not developing a severe groin wound infection after index revascularization. The predicted probability used to classify patients was >.50.