Baystate Medical Center: Full Proposal Overall Goal & Objectives

Goal: Improve patient care for hospitalized adults by implementing an institution-developed clinical practice guideline for the treatment of cellulitis or cutaneous abscess.

Objectives:

1.) Decrease the use of vancomycin for uncomplicated cellulitis
2.) Decrease the duration of intravenous therapy for uncomplicated cellulitis and cutaneous abscess
3.) Decrease the incidence of antimicrobial therapy-related complications for patients with uncomplicated cellulitis and cutaneous abscess
4.) Decrease length of stay for patients with uncomplicated cellulitis and cutaneous abscess

Current Assessment of Need

Studies report increasing hospitalization rates for skin and soft tissue infections (SSTIs), which account for approximately 600,000[1] admissions annually in the United States. With this rise in SSTIs, there has also been an increase in the prevalence of community acquired methicillin-resistant *Saphylococcus aureus* (MRSA) SSTIs requiring hospitalization.[2] However, approximately one-fifth of hospitalizations due to SSTIs involve non-purulent, uncomplicated cellulitis. Current literature supports that the majority of these infections are caused by β-hemolytic streptococci and are successfully treated with β-lactam antibiotics.[3]

Our institution admitted more than 700 patients for SSTI in 2011. Of these admissions, 86% of patients received at least one dose of vancomycin. Vancomycin is an antimicrobial agent used to treat gram-positive organisms including MRSA. Despite its frequent use, vancomycin has serious potential side effects, including nephrotoxicity. Previous work at our institution reported a vancomycin-induced nephrotoxicity incidence of 11.5% in non-critical care patients. The average length of stay for the indication of SSTI is reported as 4.4 days. However, an episode of vancomycin-induced nephrotoxicity at our institution has been shown to increase length of stay by an average of 4.5 days. Thus, vancomycin-induced nephrotoxicity for a patient admitted with an SSTI can more than double the length of their hospital stay.

Prior studies have shown improved appropriate antimicrobial choices for SSTI with the implementation of a guideline and educational efforts. Jenkins and colleagues implemented an institutional guideline to standardize the treatment of inpatient cellulitis and abscess which led to shorter durations of more targeted therapy without adverse effects on clinical outcomes.[4] However, no literature assessing such an algorithm's ability to decrease unnecessary vancomycin use has been published to date.

This proposal highlights a disparity between existing evidence and clinical practice. Non-purulent cellulitis is a common cause for hospitalization and remains treatable by β-lactam antibiotics. However, a gap in practice remains in that patients admitted with cellulitis are often exposed to avoidable vancomycin which may lead to more adverse events and increased length of stay. We are proposing an educational effort that would help clinicians with antimicrobial choices for SSTI that are appropriate, as narrow spectrum as possible, and would avoid unnecessary vancomycin use. This should ultimately improve patient care by decreasing vancomycin use, minimizing unintended consequences, decreasing the duration of intravenous therapy, and decreasing length of stay for patients with SSTI. Since most patients hospitalized

at our institution are admitted through the emergency room (ER) and then cared for as inpatients by the hospitalist attendings and internal medicine residents, these three main groups will be our target audience. The first dose of antibiotic is often chosen and administered in the ER and, in the majority of cases, this antibiotic is continued on admission.

The proposed strategy should have benefits across the healthcare continuum. Patients will see improvements in care revealed through decreased adverse events, avoidance of unnecessary broad-spectrum agents, and fewer days in the hospital. Direct patient care providers will be offered guidance regarding diagnostic tools and treatment options and duration. The institution will benefit from decreased lengths of stay and decreased readmissions for treatment failure due to inadequate antimicrobial choices.

This proposal endorses intervention methods which have been shown to be successful but have not yet been utilized to decrease unnecessary vancomycin. This approach to decrease unnecessary vancomycin use for the treatment of SSTI may be applicable to other disease states and institutions.

Intervention Design and Methods

The planned intervention will involve the creation and dissemination of a clinical practice guideline (see figure 1) that addresses appropriate management of hospitalized adults with cellulitis or cutaneous abscess. This will be followed by quarterly evaluations and education. This guideline has been reviewed by and approved by the members of our Infectious Diseases Division. The algorithm includes recommendations from the IDSA guidelines for both the treatment of MRSA infections and the treatment of skin and soft tissue infections. It prompts the clinician to differentiate between cutaneous abscess and uncomplicated cellulitis since these two distinct clinical entities usually have different causative organisms and treatment choices. Cutaneous abscesses are more likely to be caused by *Staphylococcus aureus* (either MSSA or MRSA) which could be initially treated with either vancomycin or trimethoprim/sulfamethoxazole. Furthermore, a cutaneous abscess that is drained and does not have surrounding cellulitis may not require antibiotic therapy. Uncomplicated cellulitis is most likely caused by *Streptococcus* species and could be treated initially with penicillin, cefazolin or clindamycin.

For the purposes of this intervention all individuals diagnosed with complicated cellulitis will be excluded. Complicated cellulitis includes necrotizing fasciitis and any SSTI that is accompanied by a complicating risk factor. Some complicating risk factors increase the risk of involving organisms other than *Streptococcus* species and *Staphylococcus aureus* such as diabetic or chronic ulcers, surgical wounds, human or animal bites, traumatic lesions, periorbital or orbital cellulitis, and perirectal abscess or cellulitis. Other complicating risk factors may indicate the presence of a more severe infection and also fall under the definition of complicated cellulitis. These factors include sepsis, bacteremia, deep tissue infection, indwelling medical devices, and severe immunosuppression. All other cellulitis diagnoses are considered uncomplicated for the purposes of this intervention.

In addition, some studies have shown that concomitant treatment with NSAIDs leads to more rapid improvement of uncomplicated cellulitis, and this recommendation is included in this guideline for appropriate patients for whom NSAID use is not contraindicated. The guideline also provides suggestions for oral therapy (which sometimes will depend on culture

data, when available) and a general recommendation for the total duration of therapy not to exceed 7 days. As described above, a similar method was utilized by Jenkins with success and led to shorter duration of more targeted antibiotic therapy without adversely affecting clinical outcomes.[2]

Our hospital has an established Antimicrobial Stewardship Program that provides numerous services and education to various hospital groups (residents, hospitalists, nurses, PA's). It is expected that this guideline will be the next focus of Antimicrobial Stewardship Education for the appropriate groups. In this educational program, we will disseminate the guideline through our lecture series, on the Antimicrobial Stewardship/ID website, and will also post it in resident and hospitalist work areas. Our educational efforts, detailed below will be focused in a two-month implementation period.

Since the providers in the ER often make the initial antibiotic choice, which tends to be continued upon admission, targeting all ER providers will be very important to the success of this program. Thus, efforts will be made to educate, not just residents in the ER, but all providers. The ordering providers: residents, physician assistants and attending physicians will be reached through several educational efforts. There are 39 emergency room residents and they have a mandatory weekly educational conference where we will present this treatment guideline. There are 12 PA's and 38 attending physicians in the ER who will be reached in a series of brief in-service sessions to be scheduled based on when they are working. We will have a list of all ordering providers and ensure they have either attended a group session or that we have reached them individually.

The internal medicine residents also have daily mandatory conferences where we routinely present on antimicrobial-stewardship-related topics. We will have a list of the residents and make sure they have either attended a group session or been reached individually. There are 64 internal medicine residents and 32 medicine-pediatric residents, who also spend time on the internal medicine service and care for adults hospitalized with SSTI.

The third group of providers is the hospitalist attendings. At our institution, there are two main groups of hospitalists. The larger of these groups is the 47 Baystate Medical Center hospitalists. They have a monthly meeting where we will present this information, and keep track of the providers in attendance so that we can reach the remainder individually, or by scheduling an additional education session. The other private hospitalist group has 8 providers and they will be invited to attend 1 of 2 group lunch sessions, where we will keep track of those in attendance. An effort will be made to schedule an additional session if needed or meet providers individually to educate them.

We expect that through the above sessions, we will be able to reach at least 75% of the relevant providers from ER, medicine residents and hospitalist attendings. However, we will also alert providers to this treatment guideline through a monthly electronic mailing to all providers called MD Bulletin and a notification in our electronic medical record directing providers to our webpage, which will provide a copy of the treatment guideline.

Adherence to the guideline will be evaluated quarterly during the first year after implementation. We will schedule a series of follow-up sessions to focus on success as well as areas still requiring improvement. This guideline may eventually be incorporated into our computerized physician order entry program (CPOE). However, prior studies (and experience at

our institution related to other guidelines) have not shown significant use of such electronic ordering guidelines.

Evaluation Design

Once the intervention is implemented, we will measure success by evaluating the following variables: total number of SSTI admissions during the study period, vancomycin use in this group, duration of IV therapy for SSTI, total duration of antimicrobial therapy for SSTI, and length of stay (LOS) for SSTI. Variables will be measured at the following intervals: pre and post intervention implementation and at quarterly time series analyses. The intervention will be considered successful if a 20% decrease in initiation of vancomycin therapy for the treatment of uncomplicated cellulitis is demonstrated. Another target for success is to decrease overall LOS by 0.5 days based on previous achievements with intravenous to oral conversions at our institution.

Adverse events related to antimicrobial therapy and clinical failure (treatment failure, recurrence, re-hospitalization within 30 days) will also be evaluated. Based on previous literature[4], treatment failure will be defined as a change in antimicrobial therapy or a need for additional drainage more than 7 days after the initiation of therapy due to inadequate response, and recurrence will be defined as evidence of worsening infection requiring reinitiating antibiotic therapy after completion of the initial treatment course.

The patients will be identified by our Healthcare Quality and Billing Departments through a query of ICD-9 codes for cellulitis and abscess and will include 681.x (cellulitis and cutaneous abscess of finger and toe), 682.x (other cellulitis and abscess), 035 (erysipelas), and 686.x (other infections of skin and subcutaneous tissue). The query will also provide antimicrobial agents received, duration of therapy, route of therapy, and length of stay data. Additionally, we will be doing retrospective chart reviews to precisely characterize infections as abscess or uncomplicated cellulitis, evaluate for clinical outcome/failure, and clarify adverse events related to antimicrobial therapy. The control group will be the pre-intervention time period. All of this information will be obtainable through the patient's electronic medical record

We plan to present this work at a National Pharmacy and/or Infectious Disease Conference. On a more local level, we plan to present quarterly updates for at least the first year after implementation to the involved groups of residents and hospitalists at our institution.

Project Timeline

The entire project will take place over the course of approximately 2 years (see table 1). The guideline was drafted and submitted to the Infectious Diseases division at Baystate Medical Center for review. The protocol for this study will be submitted to the institutional review board (IRB) for approval in October 2012. Guideline implementation and associated education will occur in November and December 2012. On-going education and follow-up will be scheduled as necessary throughout 2013 based on quarterly analysis of preliminary post-implementation data used to evaluate adherence to the guideline.

Data collection for the pre-intervention group will occur from November 2012 to April 2014 while data collection for the post intervention group will occur from January to April 2014.

Once all data has been collected, analysis and evaluation of the two groups will be completed in April 2014. A manuscript for publication will be drafted and submitted for publication by the close of June 2014.

Figure 1: Algorithm for Management of Cellulitis or Cutaneous Abscess in Hospitalized Adults

October 5, 2012

Clinical Practice Guideline

Management of Hospitalized Adults with Cellulitis or Cutaneous Abscess

Cellulitis and/or cutaneous abscess

Concern for necrotizing fasciitis? — Yes → Obtain immediate surgical consultation

No

Complicating risk factors present? — Yes → Complicated SSTI
- Treatment varies
- Consider ID consultation

- Diabetic or chronic ulcer
- Surgical wound
- Periorbital or orbital cellulitis
- Sepsis
- Indwelling medical device
- Perirectal abscess or cellulitis
- Bacteremia
- Human or animal bite
- Burns
- Severe Immunosuppression (eg: organ transplant, neutropenia)

No

Cutaneous abscess present?

Yes → Uncomplicated cutaneous abscess with surrounding cellulitis (Suspected Pathogen: *S. aureus*)

- I&D*, send purulent material for gram stain and bacterial culture
- Blood cultures only if signs of systemic toxicity
- Start**: Vancomycin OR trimethoprim/sulfamethoxazole***
- Elevate affected area

Adequate clinical response in 48-72 hours?

Yes →
- Ensure adequate drainage
- Tailor antibiotic therapy based on culture results
- Transition to oral therapy
- Depending on microbiology results, possible oral agents may include:
  - Trimethoprim/sulfamethoxazole
  - Doxycycline
  - Clindamycin
- Total duration of therapy: 7 days (5 days or less if well-drained abscess without significant surrounding cellulitis)

No → Consult Infectious Diseases Services

The following are not routinely indicated for the initial management of uncomplicated SSTIs:
- ESR
- CRP
- Plain films*****
- CT or MRI
- Gram-negative and anaerobic antimicrobial coverage

No → Uncomplicated cellulitis (Suspected Pathogen: Streptococci)

- Wound swab culture not indicated
- Blood cultures only if signs of systemic toxicity
- Start: Penicillin OR Cefazolin OR Clindamycin
- Consider: Ibuprofen******
- Elevate affected area
- Appropriate therapy for underlying condition that may have predisposed to cellulitis

Adequate clinical response in 48-72 hours?

No → Consult Infectious Diseases Services

Yes →
- Transition to oral therapy
- Suggested oral agents if no microbiology data:
  - Penicillin
  - Cephalexin
  - Doxycycline
  - Clindamycin
- Total duration of therapy: 7 days

*Incision and drainage should be considered the primary therapy for cutaneous abscess

**If not systemically ill, no surrounding cellulitis and abscess less than 5cm, antibiotics may not be necessary

***Bactrim is a reasonable option if not systemically ill and if this agent was not previously used for this infection

****Unless contra-indicated (such as due to an allergy, renal dysfunction, or concomitant nephrotoxic medications)

*****Plain films should be considered if concern for fracture, gas or foreign body

Table 1: Project Timeline	
Draft guideline	September 2012
Submit IRB proposal	October 2012
Collect data for pre-intervention group (January – December 2011)	November 2012-April 2013
Hospital-wide education and guideline implementation	November - December 2012
On-going education and follow-up	January – December 2013
Collect data for post-intervention group (January – December 2013)	January – April 2014
Analysis and evaluation of results	April 2014
Submit manuscript for publication	June 2014

References

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