Adherence to Early Resuscitation Bundle for Severe Sepsis; a multi-hospital system review

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Presenter Disclosures

Rosemarie P. Linton, MPH

The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:

No relationships to disclose

Objectives

- Discuss implementation of Sepsis Initiative at North Shore-LIJ Health System
 - o Intervention: Institution of IHI Modified Severe Sepsis 3-Hour Resuscitation Bundle
- Describe the development of a standardized database for evaluation of process and outcomes data
- Share results of a 2 year observational review of compliance rates and its effects on mortality and length of stay

Introduction

Sepsis and the Elderly

- Patients aged 65 years and older represent 2/3 of all sepsis or septicemia discharges in the United States (1).
- According to the National Center for Health Statistics, annual hospitalizations with septicemia or sepsis surpassed 1,000,000 in 2008 (1).
- Aging population in 2000 persons 65 years and older represented 12.4% of population but by 2030 elderly population is expected to grow to 19% of total population (2).

(1) National Center for Health Statistics (http://www.aoa.gov/Aging_Statistics/). (2) Administration of Aging (www.cdc.gov/nchs/data/databriefs/db62.htm).

Introduction

Sepsis and the Elderly

- According to a study published in Critical Care Medicine (2001), severe sepsis incidence rates were projected to increase by 1.5% per annum.(3)
- Analysis on the Nationwide Inpatient Sample (NIS) between 1993 and 2003 however, revealed that the hospitalization rate of severe sepsis outpaced the prediction (4)
- Prior to 2004, in-hospital mortality rates of severe sepsis ranged between 30% 50% (3,5)
- public Health concern

(3) Angus DC, Linde-Zwirble WT, Lidicker J et al. Epidemiology of severe sepsis in the United States: analysis of incidence, outcome, and associated costs of care, Crit Care Med. 2001; Jul; 29(7): 1303-10.

(4) Onambrosky W, Martin AS, Sunderran J. et al: Raqial increase in hospitalization and mortality rates for severe sepsis in the United States: A trend analysis from 1993 to 2003. Crit Care Med 2007; 35:1244-1250.

(5) Rivers E. Ngwen B. Haysted S., et al: Early goal-directed therapy in the treatment of severe sepsis and septic shock. N Eng J Med 2001;345:1388-1377.

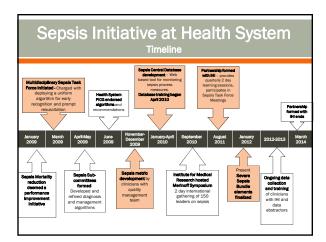
Introduction

Sepsis Initiative at Health System

- Surviving Sepsis Campaign (SSC) and Institute for Healthcare Improvement (IHI)
- CEO of North Shore-LIJ Health System, Michael Dowling, prioritized sepsis mortality reduction as a performance improvement initiative
- North Shore-LIJ Health System
 - Health System serving 7 million people in Long Island, Queens, Manhattan, and Staten Island
 - o 11 hospitals: 5 tertiary / 6 community
 - o Over 4,200 beds
 - o Over 250,000 inpatient discharges per year
 - o Over 500,000 ED visits per year

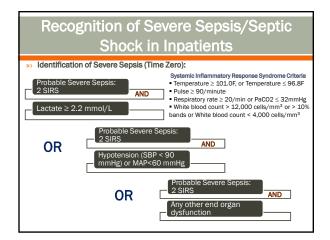
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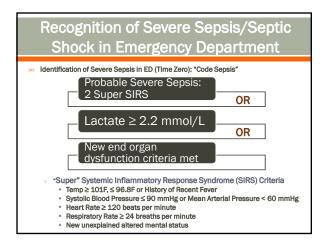
Introduction Sepsis / Severe Sepsis / Septic Shock Septic Shock Severe Sepsis Sepsis ICD-9-CM: 995.92 and 785.52 Suspected • Vital organ infection dysfunction severe sepsis accompanied accompanies with by presence of sepsis associated 2 systemic hypotension • The result of inflammatory (low blood an excess of pressure) response normal syndrome (SIRS) antimicrobial despite adequate fluid host defense conditions resuscitation mechanisms



Sepsis Initiative at Health System Highlights Sepsis Task Force was established in March 2009, comprised of over 30 members meeting monthly. Multidisciplinary team Defined sepsis/severe sepsis/septic shock and reviewed principles of Surviving Sepsis Campaign (SSC) Sepsis bundles and time limits (6-hour, 24-hour) were defined (and redefined according to SSC updates) Initial focus in recognizing sepsis in ED before patient admitted to critical care unit. By end of 2009, clinicians and the quality management team developed uniform sepsis metrics to be captured in central database. Database developed in early 2010, training immediately followed. A major milestone in August 2011 was the start of our strategic partnership with IHI that concentrated on reducing sepsis mortality. January 2012 - present severe sepsis 3-hour bundle elements were finalized.

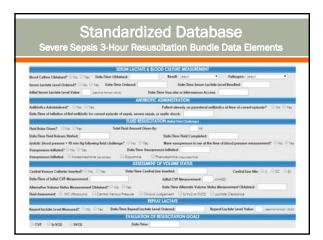
Collaboration with IHI provided extensive education of clinicians To quickly recognize sepsis and severe sepsis To successfully implement the Severe Sepsis Resuscitation Bundle Regarding the bundle, IHI trained our staff by: providing clinical evidence for use of bundle elements discussing key barriers to delivering treatment in specified time frames providing possible solutions to these barriers.





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Severe Sepsis Resuscitation Bundle	
Blood culture assessed before antibiotics administered Administer broad-spectrum antibiotics within 180 minutes	
Health System Severe Sepsis	
Resuscitation Bundle	
Serum lactate values Fluid bolus obtained within 90 administered	
minutes of order time within 30 minutes	
Measuring Adherence to Bundle	
Monitoring the 4 separate processes for the health system required uniform data collection of associated key metrics	
Solution Various data systems throughout health system (Electronic Medical Record/paper)	
Krasnoff Quality Management Institute (KQMI), a division of North Shore-LIJ Health	
System charged with developing a central database	
	1
Standardized Database Development	
Data elements related to diagnosis and	
administration of the bundle were delineated by clinical members of Sepsis Task Force to KQMI	
Expert staff at KQMI developed a user friendly web tool with an Oracle database as a back end	
to capture demographics, clinical data elements, process and outcome measures	
© Logic was built into the web tool to aid in	
accurate and clean data entry	

Stariuai	dized Data	avası	-
Criteria Elements	for Severe Sensis	s/Sentic	Shock
5.1.6.1.6 2.5.115.1.65	ioi conoro copoio	, оорас	O. I O O I I
	PSS EVALUATION & IDENTIFICATION		
3.50	SIRS Criteria		
Check are of the following signs and couptions of infection both present and			
☐ Temperature >= 16.3 °C (min/m) ☐ Temperature <= 3i		E Respiratory	nate >+ 20/min or PoCO2 < 32 monito
Sand count more than 3% of the total WSC at time of sepsis di If any tag SIRS criticis above out, Date Time Sepsis Mentified must be away		d DWSC count	> 12,000 ml
Sepsis identified by what criteria? ** Lactate Order *** Annatati	po Dole/Tim	re Sepsis Identified:	
Palient Care Unit Where Sepus Identified: 0 ED 0 ED Hold	O'Cifical Care Unit O'Inpatient O'C	DU	
	Super SIRS ED Triage Criteria	-	
Check any of the following signs and symptoms of infection both present and	new to patient at time of identification:		
Did the patient meet SUFER SIRS criteria at ED triage? Site STre			
☐ Temperature >= 363 °C (111.1 Y)	☐ Temperature <= 36 °C (HLEY)	Li Pute 24 1	20/min
Respiratory rate her 14	Acutely altered mental status	138F + 90 +	nortig or MAP < 65 mortig
	New Organ Dysfunction Ortholia		
Ties or increased 02 requirement to maintain SoC2 > 10%	☐ Creatinine > 2.0 mg/s/ prez er	ниц от 50% почесня	hom known baselne
☐ Pis00(RO2 totio < 300	Divine output < 0.5 millig/hour	for>2 hs	Ellistin > 2mg/d (xxx mmx)
Flatelet count at time of sepsis diagnosis < 150,000 pels/mm3	☐ Coopulapathy (ser) (ser e mo	MI MOS	Blockstein 22 mmol/Literary in
SBF < 90 mmHg or MAP < 65 mmHg	139 decrease > 40 mmHg from		W Acutely offered mental status
If patient has Lactate >= 2.2 with Septis Criteria or Reputersion (SBP +88 to Septis Septic Shock Mentified must be completed below. If the patient seet "I		sounted in provider note	n atherwise not explained, Date Time Severe
Date Time Severe Sepsix Septic Shock Identified:			
Patient Care Unit Where Severe Sepsis/Septic Shock Identified:	ED DED Hold O'CHical Care Uni	Total Constant	V cou



Severe Sepsis Bundle Adherence Study Database allows statistical analysis Bundle Adherence Changes from 2012 to 2013 Chi-square tests Association of Adherence with mortality, LOS Z-Test for Independent Proportions Independent Samples Student's t-Test Chi-Square Trend and Chi-Square Linearity Logistic Regression for Adjusted Odds Ratios

Severe Sepsis Bundle Adherence Study

- Retrospective 2-year observational cohort of patients 65 years or older discharged (2012-2013) with severe sepsis or septic shock
- so Elderly population 70% of all severe sepsis cases
- - ♦ Transfer patients
 - Cases with documented goals of care at the time of Sepsis identification that precluded compliance with the treatment bundle.
- № N=8,059. 7,753 (96.2%) admitted via the ED
- All-or-none bundle compliance computed as binary variable for each patient with severe sepsis.

Bundle Adherence Results					
	Difference 2013 vs. 2012				
Component of Severe Sepsis Bundle	2012- 2013	2012	2013	P Value	
Blood culture component adherence	90.1%	88.3%	91.3%	<0.001	
Antibiotic component adherence	85.1%	81.8%	87.4%	<0.001	
Lactate component adherence	84.5%	83.2%	85.3%	0.016	
Fluid bolus component	58.4%	53.8%	61.1%	<0.001	

All-or-None Bundle Adherence

All-or-none compliance with severe sepsis bundle

11 Health System hospitals (N=5,405) 41.9%

35.2% in 2012 and 45.7% in 2013 (p<0.001)

5 Tertiary hospitals (N=3,567)

40 3%

32.6% in 2012 and 44.5% in 2013 (p<0.001)

6 Community hospitals (N=1,838)

44.9%

39.9% in 2012 and 48.0% in 2013 (p=0.001)

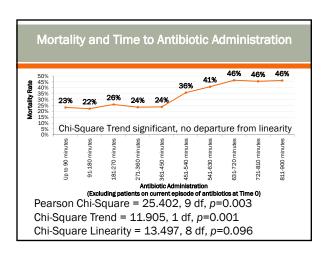
Significant difference in Community and Tertiary rates, Chi-Square Difference p<0.01

Mortality and Bundle Adherence

Primary Objective: To examine if an association existed between adherence to system's severe sepsis bundle and mortality

- Mortality rate for non-adherent set 25.6%
- Mortality rate for adherent set 22.2%
- Mortality rate reduction 3.4% (95% CI=1.1%,5.7%)
- Difference in proportions tested with Z-test for independent proportions (p=0.00385)

Mortality and Bundle Components Results				
Results of five separate logistic regression models of hospital mortality each adjusted for age, weight (kg), and admission unit (Inpatient, Intermediate, Critical, or Other).				
Variable	Value	Adjusted Odds Ratio (95% confidence interval)	P Value	
Blood cultures before antibiotics	Non-Adherent Adherent	0.97 (0.79, 1.21) Referent	0.811	
Broad spectrum antibiotics within 180 minutes	Non-Adherent Adherent	1.29 (1.10,1.52) Referent	0.002	
Lactate result within 90 minutes	Non-Adherent Adherent	1.18 (1.01, 1.38) Referent	0.038	
Fluid bolus within 30 minutes	Non-Adherent Adherent	1.02 (0.90, 1.17) Referent	0.717	
Complete Severe Sepsis Resuscitation Bundle	Non-Adherent Adherent	1.22 (1.06, 1.40) Referent	0.007	



Length of Stay and Bundle Adherence Results

Secondary Objective: To examine if morbidity was improved via adherence to severe sepsis bundle, evidenced by significant reduction in length of stay

- ALOS for non-adherent set 10.3
- ALOS for adherent set 9.1
- ALOS reduction 1.2 days (95% CI=0.6, 1.9)
- Difference in ALOS tested with independent samples Student's t-test (p<0.001)

Exploratory Analysis: Mortality and Blood Cultures for Patients on Antibiotics at Sepsis Diagnosis

Patients on current episode of antibiotics at Time Zero				
Blood Culture Component of Bundle	Expired	Survived	Total	
Not received	49 (41.2%)	70 (58.8%)	119	
Received	114 (26.0%)	324 (74.0%)	438	
Total	163 (29.3%)	394 (70.7%)	557	

- Odds ratio=1.99 (1.30, 3.04), p=0.001
- Adjusted odds ratio=1.92 (1.22,3.02), p=0.005

Based on these findings, all patients even those with a pre-hospital administration of antibiotics should have a culture taken prior to administering antibiotics

Limitations

- As an observational study only association between bundle completion and mortality can be assessed. Causal relationship cannot be inferred.
- Missing date/time values
- would be best not to include patients that had clinical reasons for exclusions from analysis, and note reasons for exclusions

Conclusion

- so Analysis not a pre-post intervention study but observational review of all-or-none adherence, 2012-2013
 - Intervention of clinical education of bundle ongoing process throughout cohort
- $_{\mbox{\scriptsize 50}}$ Severe sepsis/septic shock mortality at the Health system was over 30% in 2010. In 2013, the overall in-hospital mortality rate was 22.6%
- so Complete adherence associated with lower mortality and LOS
- so For patients on pre-hospital administration of antibiotics, hypothesis is that they are on inappropriate antibiotic entering
- Mhile examination is underway, recommended to obtain blood cultures on **all** patients meeting severe sepsis criteria

Questions?

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Krasnoff Quality Management Institute, a division of North Shore-LIJ Health System

Thank you!





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