

**Diagnosis of VAP:
BAL,
Sputum Culture, or
Clinical?**

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Diagnosis of VAP

- *options* -

- **Sputum culture**
 - simple
 - sensitive, not specific
 - unnecessary antibiotics
- **Clinical Pulmonary Infection Score**
 - simple
 - pulmonary inflammatory response
 - antibiotic duration
- **Bronchoalveolar lavage**
 - more labor intensive
 - sensitive & specific
 - more appropriate antibiotics

Methods

- 107 Ventilated Patients -

- **Clinical VAP (fever, leukocytosis, sputum, x-ray)**
- **Triplicate cultures:**
 - **Routine sputum aspirate (RS)**
 - **Protected specimen brush (PSB)**
 - **Bronchoalveolar lavage (BAL)**
- **Therapy based on RS**

Study Population

- 107 Patients with 136 Culture Sets -

M / F **79% / 21%**

Age **40 years**

ISS **29**

Blunt **78%**

Penetrating **22%**

Criteria for VAP Diagnosis

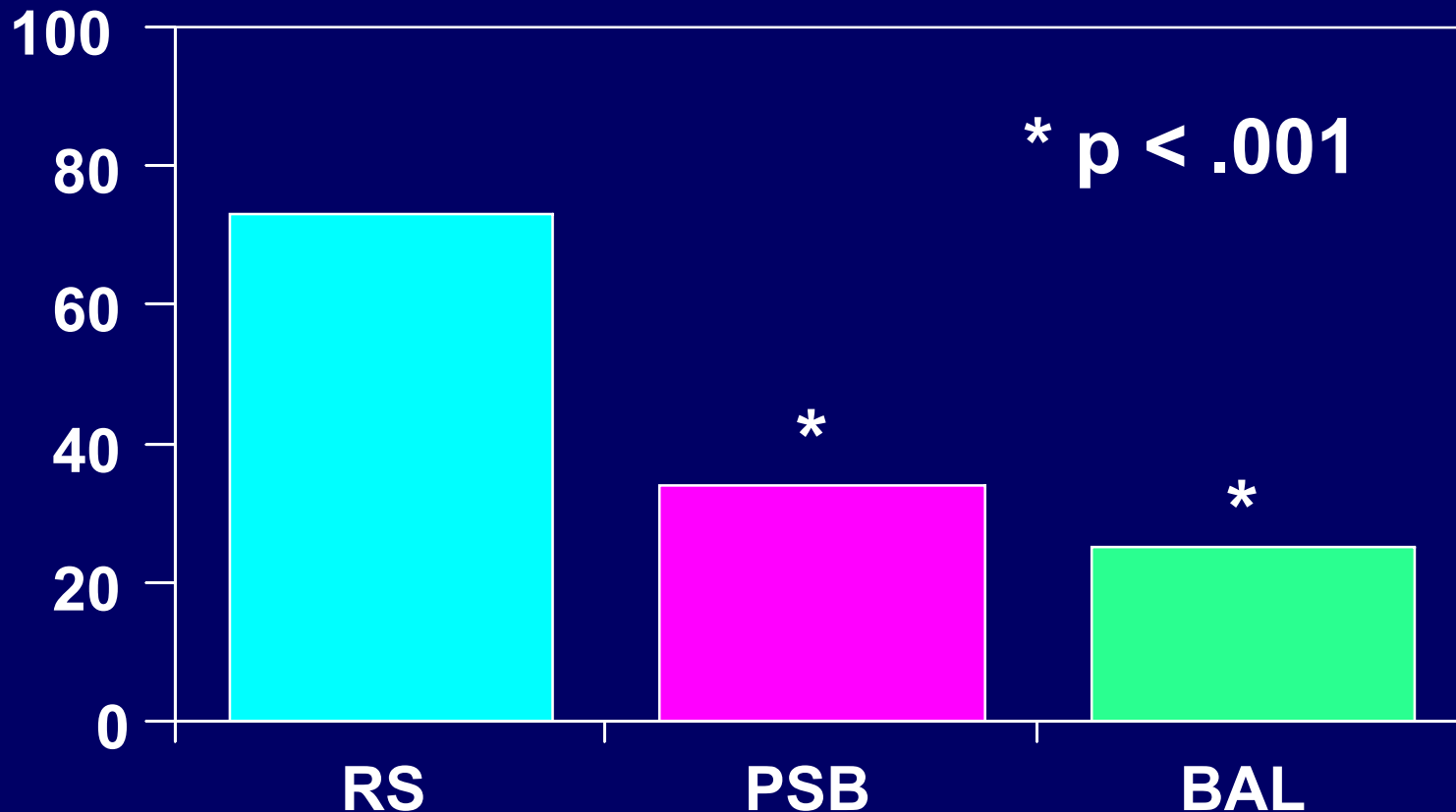
RS = presence of pathogen(s)

PSB = $\geq 10^3$ cfu / mL

BAL = $\geq 10^5$ cfu / mL

Incidence of VAP

- 136 Cultures -



Charges for VAP Diagnosis

Bronchoscopy	\$ 454.50
Quantitative culture	190.84
Routine culture	149.57
Protected brush	46.56
Cytology	28.00

Total charges: RS \$ 149.57

PSB 691.90

BAL 673.34

Antibiotic Charges

Drug	3 Day Rx	14 Day Rx
Imipenem	\$ 422	\$ 1967
Aztreonam	516	2407
Ciprofloxacin	346	1612
Ceftazidime	534	2490
Ticarcillin	335	1562
Piperacillin	554	2584
Vancomycin	131	612
Amikacin	765	3570

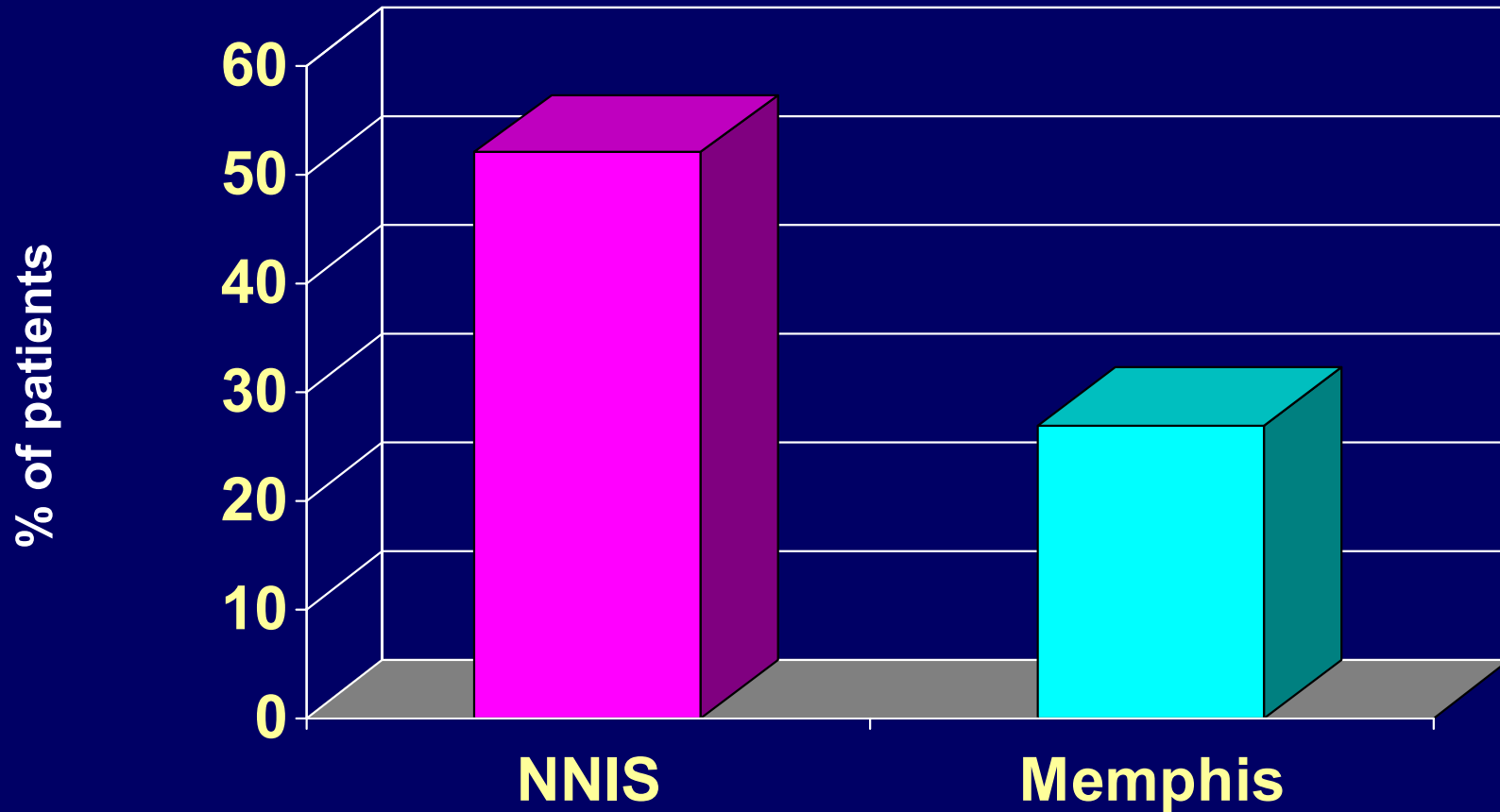
Overall Patient Charges (\$)

- Ceftazidime & Vancomycin -

	FOB	Micro	Drug	Total
RS	--	20,341	282,489	302,830
PSB	68,130	25,954	82,863	176,947
BAL	61,812	29,762	37,665	129,239

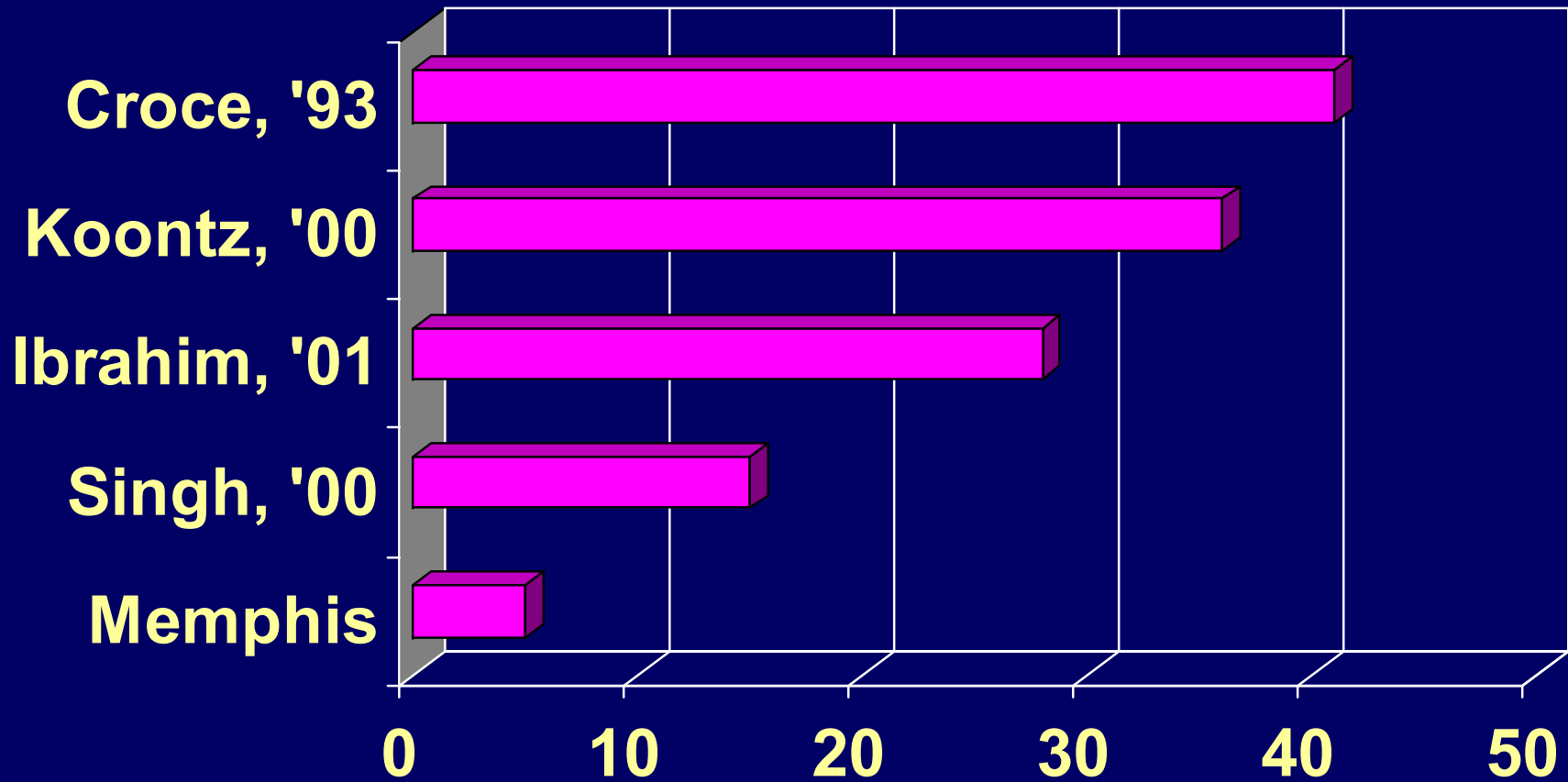
Development of Resistance

- MRSA -



Development of Superinfections

- review -



Conclusions

- **Basing therapy on sputum cultures
increases costs and resistant organisms**

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CPIS

- Temperature
- Blood leukocytes
- Tracheal secretions
- $\text{PaO}_2 / \text{FiO}_2$
- Chest radiograph

Scores range 0 - 10

Validation of CPIS

- > 6 for VAP diagnosis -

- Based on Bacterial Index (sum of exponents)
- Sensitivities of 70 - 90%
- Specificities of 40 - 90%
- **CPIS > 6** “virtually excluded acute lung injury, pulmonary edema, atelectasis, or contusion as causes of pulmonary infiltrates in ICU patients”

Methods

- Patients identified from VAP database
- Merged with trauma registry (NTRACS)
- VAP diagnosed by quantitative BAL cultures
 - $\geq 10^5$ = VAP
 - $< 10^5$ = SIRS
- Variables collected

Admission

demographics

injury severity

Time of BAL

APACHE II

CPIS (> 6 = VAP)

- Primary outcome - VAP

Group Comparison

- VAP -

	SIRS (n = 166)		VAP (n = 119)
Age	37	p<.04	44
ISS	32		30
Chest AIS	2.5		2.3
APACHE II	18		16
GCS	10		11
Days to BAL	13	p<.03	9

Group Comparison

- VAP -

	SIRS		VAP
BI	4.3	$p < .001$	13.7
CPIS	6.8		6.9
CPIS ≤ 6	43%		39%
CPIS > 6	57%	$p < .43$	61%

CPIS for VAP Diagnosis

- *CPIS* > 6 = VAP -

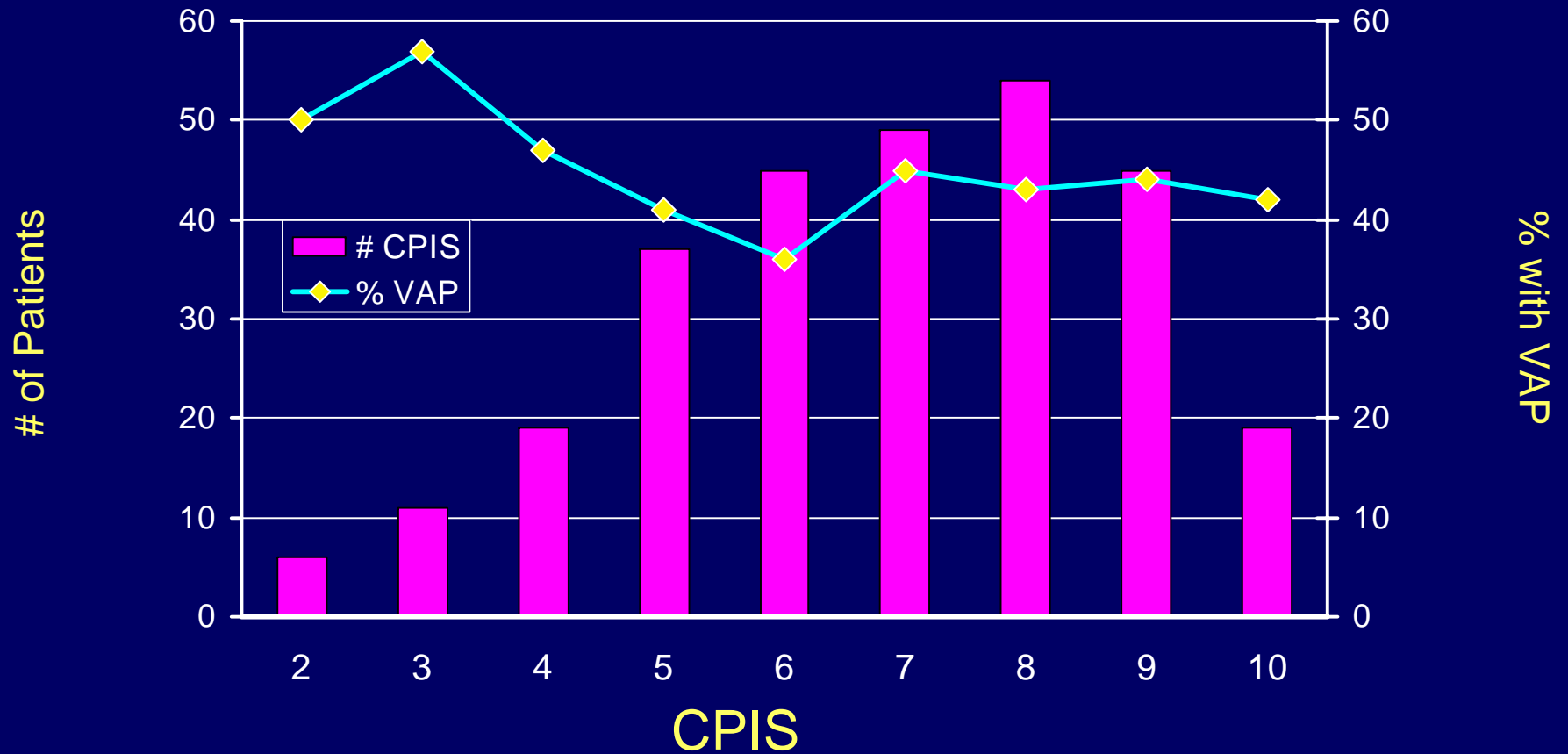
Sensitivity 61%

Specificity 43%

PPV 44%

NPV 62%

CPIS and VAP



Conclusions

- Basing therapy on sputum cultures
increases costs and resistant organisms
- CPIS cannot differentiate *inflammation*
from *infection* in critically injured patients

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Clinical infection?

PSB or BAL

Bacteria present?

Signs of severe sepsis

Immediate antibiotics

Immediate antibiotics

Positive cultures?

Positive cultures?

Continue or adjust antibiotics

Continue or adjust antibiotics

Adjust antibiotics

Methods

- **Mechanically ventilated trauma patients**
- **Clinical evidence of pneumonia**
 - **Fever, leukocytosis, purulent sputum, infiltrate**
- **No other obvious infection**
- **Concomitant antibiotics acceptable**
- **FOB with BAL**

Definitions

VAP

BAL with $\geq 10^5$ cfu / mL

SIRS

BAL with $< 10^5$ cfu / mL

**False negative
BAL**

**Previous SIRS with
subsequent BAL $\geq 10^5$
cfu / mL of same
organism within 7 days**

Study Population

- 232 Patients -

M/F 71%/29%

Age 41 years

ISS 30

GCS 11

Pulm Cont 58%

Smokers 59%

Mech of Injury



Protocol

FOB with BAL & Gram's stain of effluent

G ⊕ → vancomycin

< 10^5 cfu/mL

Antibiotics
stopped
(SIRS)

61%

≥ 10^5 cfu/mL

Antibiotics
continued
(VAP)

39%

Group Comparison

	VAP	SIRS
N	173	270
Age	42	40
GCS	11	11
% Pulm. cont.	63	59

Mortality

	Lived		Died
VAP	80%		20%
SIRS	84%		16%
False negative	13		4
Age	39	$p < .005$	48
ISS	29		32
GCS	11		11

False Negative BAL

- 17 patients -

	False negative		True negative
Age	42		41
ISS	36	$p < .04$	30
GCS	10		11
% Pulm Cont	65		60
% Mortality	24		17

Conclusions

- Basing therapy on sputum cultures
increases costs and resistant organisms
- CPIS cannot differentiate *inflammation*
from *infection* in critically injured patients
- Therapy for VAP should be based on the
quantitative culture results

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Diagnostic Algorithm for VAP

Clinical evidence of VAP

Fever
Leukocytosis
Purulent sputum
Infiltrate

FOB with BAL, Empiric therapy

ICU < 7 days
Ampicillin/Sulbactam

ICU > 7 days
Cefipime+Vancomycin

< 10^5 cfu/ml

Stop antibiotics

$\geq 10^5$ cfu/ml

Continue antibiotics