PNEUMONIES NOSOCOMIALES

Pourquoi le diagnostic des PN est-il si difficile ?

Centre Hospitalier Universitaire
Lille
Cliniques des Maladies Respiratoires

Charles H MARQUETTE

- Position du problème
  - Pourquoi est il justifié de faire le diagnostic des PN ?
    - relation PN ⇔ mortalité ?

- Pourquoi le diagnostic des PN est-il si difficile ?
  - Valeur des signes cliniques
  - Valeur des signes radiologiques
  - Particularités histologiques
  - Place des techniques invasives

relation PN ⇔ mortalité

- Mortalité des PN en service de réanimation
  - mortalité globale 40 à 80 %
  - mortalité attribuable ?
    - les PN sont un facteur de risque de DC indépendant

Variables independently associated with death in ICU patients

Variable	Odds ratio	*P*
APACHE II score	1.08	<0.001
No. of dysfunctional organs	1.54	<0.001
Nosocomial pneumonia	2.08	<0.001
Nosocomial bacteremia	2.51	<0.001
Fatal underlying disease	1.76	<0.001
Admission from other ICU	1.30	0.04

From Fagon et al. 1996 [3]. With permission of the American Medical Association.

relation PN ⇔ mortalité

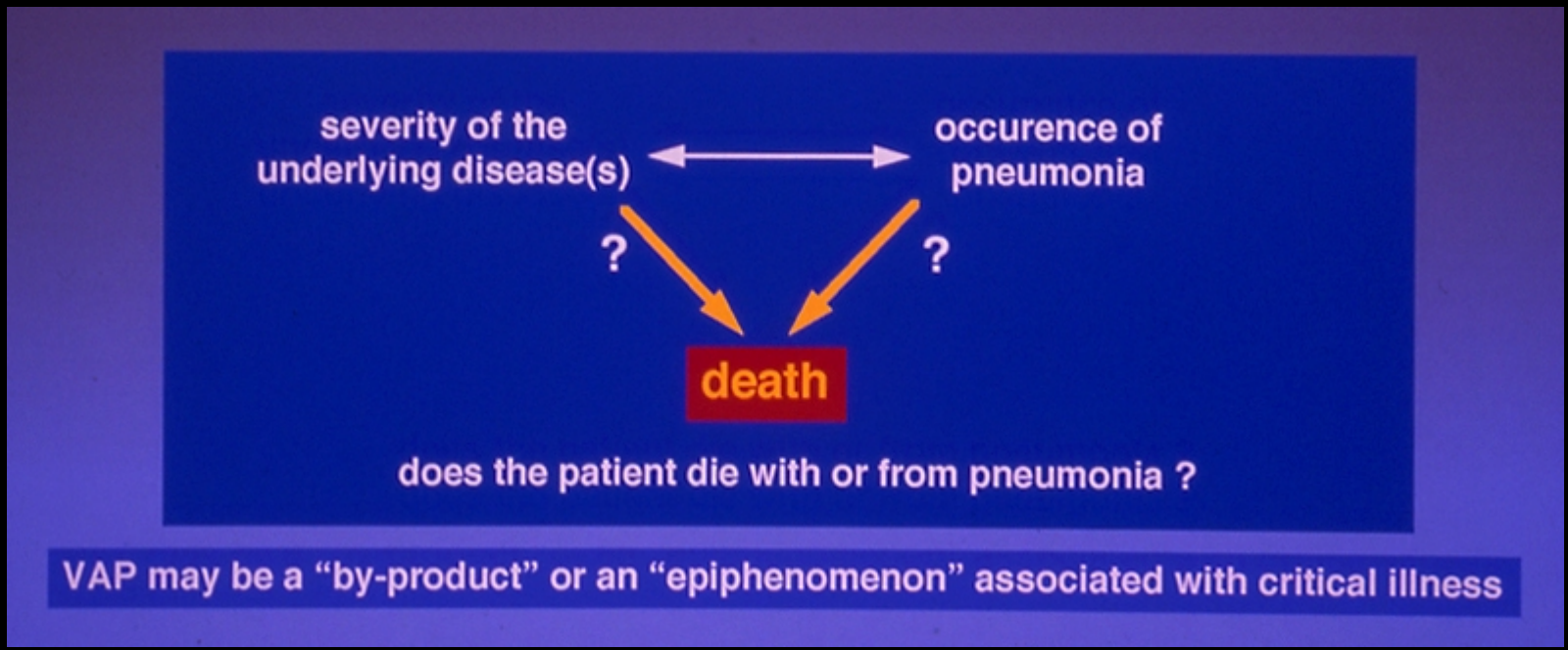
- Mortalité <u>attribuable</u> aux PN en réanimation ???

Les résultats dans la littérature sont contradictoires

- design de l'étude
  - rétrospective, prospective, stepwise logistic regression analysis, matching cohorts, etc ...
- taille de l'échantillon
- timing de la pneumonie (early *vs* late)
- durée d'exposition (days on MV)
- population
  - médicale *vs* chirurgicale
  - gravité basse, intermédiaire ou élevée
- stratégie diagnostique
- adéquation du traitement initial

relation PN ⇔ mortalité

Mortalité <u>attribuable</u> aux PN en réanimation ???



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relation PN ⇔ mortalité

PN et SDRA

effect marginal de la PN sur le pronostic

Author	nb pts	% VAP	mortality VAP	mortality no VAP	
Chastre AJRCCM 1998	56	55%	52%	72%	NS
Delclaux AJRCCM 1997	30	60%	78%	92%	NS
Markowicz AJRCCM 2000	134	36%	57%	59%	NS
Sutherland AJRCCM 1995	105	15%	38%	45%	NS

diagnosis based on invasive techniques

relation PN ⇔ mortalité

PN et polytrauma

Baker et al. AJRCCM 1996

- 29 pts
- étude rétrospective cas-controles
- diagnostic: PCB ou BAL
- flore oropharyngée : 45 % des organismes causaux

	cas	controles	
mortalité (%)	24	24	ns
durée de séjour (j)	20	15	ns

relation PN ⇔ mortalité

population médicale *vs* chirurgicale

- 177 pts
- étude prospective cas-controles
- diagnostic: clinique

	cases	controls	
mortalité (%)	23.7	17.7	ns
durée de séjour (j)	19	14	ns

- durée de séjour
  - med vs chir: 6.5 vs 0.7 days (p< 0.04)
- Mortalité attribuable
  - med vs chir: 65 % vs -27.3 % Relative risk increase (p<0.04)

Heyland et al. AJRCCM 1999

relation PN ⇔ mortalité

ref	pts	methods	diagnosis	ICU stay(d) cases	ICU stay(d) control	mortality (%) cases	mortality (%) control
Fagon AJRCCM 1993	48 MV>72h 48 matched pairs	retrospect same indic for MV, age, SAPS prior lenght of exposure	positive PCB or 5% ICO	34	21	54	27
Papazian AJRCCM 1996	97 MV > 48h 85 matched pairs	prospective same diagnosis same indic for MV, age APACHE, prior lenght of exposure	positive PCB	21	16	40	38.8
Heyland AJRCCM 1999	177 MV > 48h 164 matched pairs	prospective same diagnosis same indic for MV, age APACHE, prior lenght of exposure med/surg, MOD score day -1	clinical suspicion	19	14	23.7	17.7

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Valeur des signes cliniques: problèmes méthodologiques

- obtaining the correct denominator
  - major methodological problem in assessing the sensitivity or specificity of clinical criteria
- instead of providing the total nb of pts at risk
  - many studies give only the nb of pts who met at least one criterion
  - or the nb who gave a subjective clinical impression of being at risk for VAP

$\Rightarrow$sensitivities may be lower and specificities higher if data from these studies are applied to the entire population of ventilator-assisted patients

Wunderink Chest 2000;117:191S-194S

Valeur des signes cliniques: problèmes méthodologiques

- the sensitivity derived from the entire population is inappropriately high when applied only to a preselected population
  - all febrile pts or all pts with purulent tracheal secretions

- the appropriate calculation depends on the question being addressed
  - if the clinical criteria are used to select a population at high risk of VAP
    ⇒population-based statistics should be used
  - if the goal is to discriminate between patients with VAP and those with a mimicking condition
    ⇒the criteria characteristics in the suspected VAP group should be used.

Wunderink Chest 2000;117:191S-194S

Valeur des signes cliniques

- Combinations of
  - Fever OR leukocytosis OR purulent secretions
  - AND a radiographic infiltrate
  - ⇒ performs well in the population preselected for suspected VAP

- requiring all three clinical findings and radiographic abnormalities
  - ⇒ increased the specificity but lowered the sensitivity to an unacceptable 48%

Wunderink Chest 2000;117:191S-194S

Valeur des signes cliniques

Clinical diagnosis revisited Fabregas et al. Thorax 1999

Diagnostic accuracy of clinical variables and diagnostic techniques for the presence of pneumonia

variable	sensitivity (%)	specificity (%)	PPV (%)	NPV (%)
Chest-X ray plus 2 of 3 criteria	69	75	75	69
TBA ($\geq 10^5$ cfu/ml)	69	92	90	73
BAL ($\geq 10^4$ cfu/ml)	77	58	67	70
PSB ($\geq 10^3$ cfu/ml)	62	75	73	64

The CPIS score was not more accurate

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Valeur des signes radiologiques

- Sensitivity
  - alveolar infiltrates 87 - 100 %
  - air bronchogram sign 58 - 83 %
  - new or worsening infiltrates 50 - 78 %
- Specificity ?
  - no or few patients whithout pneumonia and normal CXR !!

Wunderink Chest 2000;117:188S-190S

HISTOLOGIE: Particularités des Pneumonies nosocomiales

- Association à d'autres lésions pulmonaires (>50%)
  - Atélectasie
  - SDRA
  - Œdème
  - Infarctus

  Rouby *et al*, ARRD 1992, Marquette *et al*, AJRCCM 1995

- Bronchopneumonie ⇔ PFLA

- Hétérogénéité
  - des lésions dans l'espace
  - de la charge bactérienne

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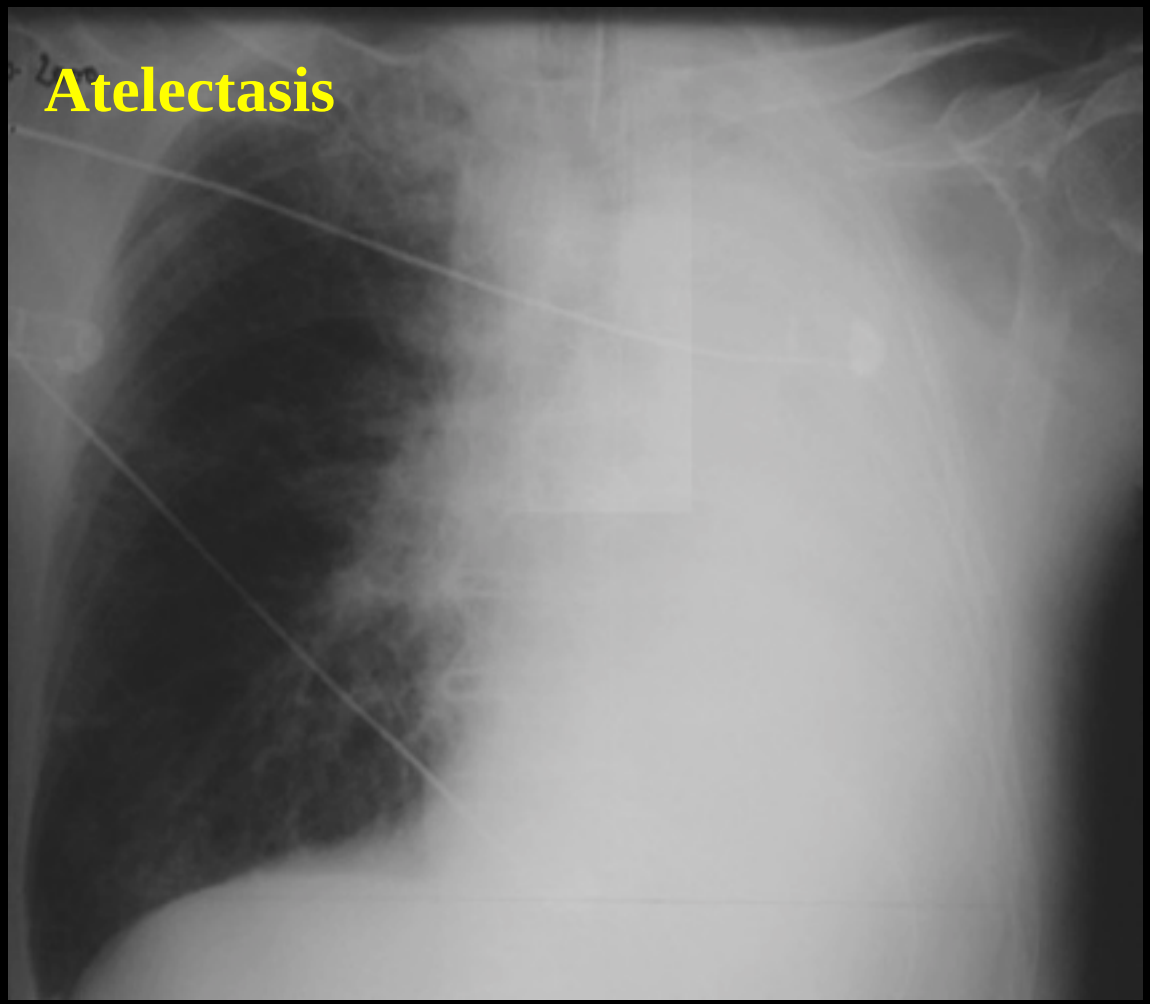

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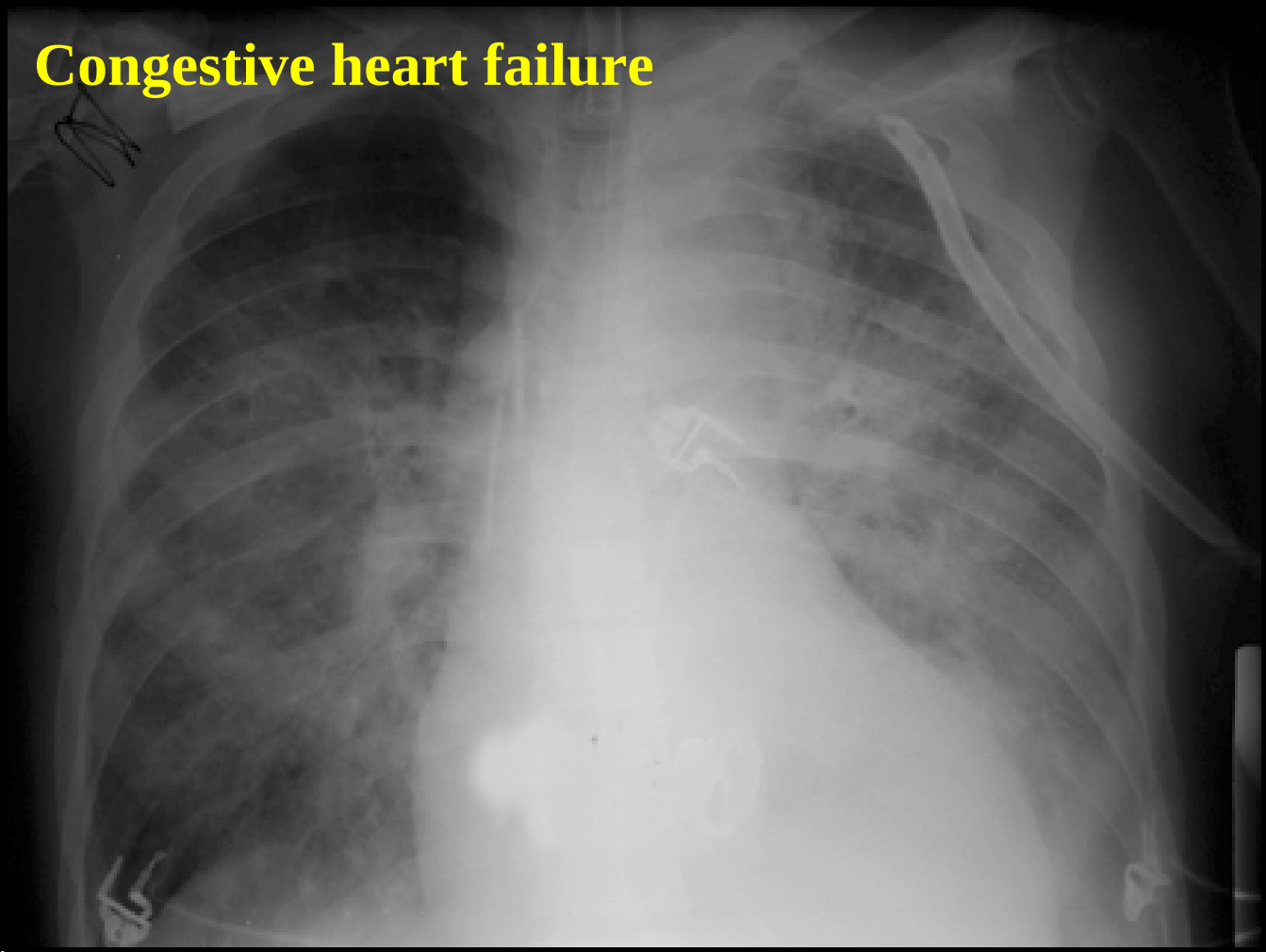

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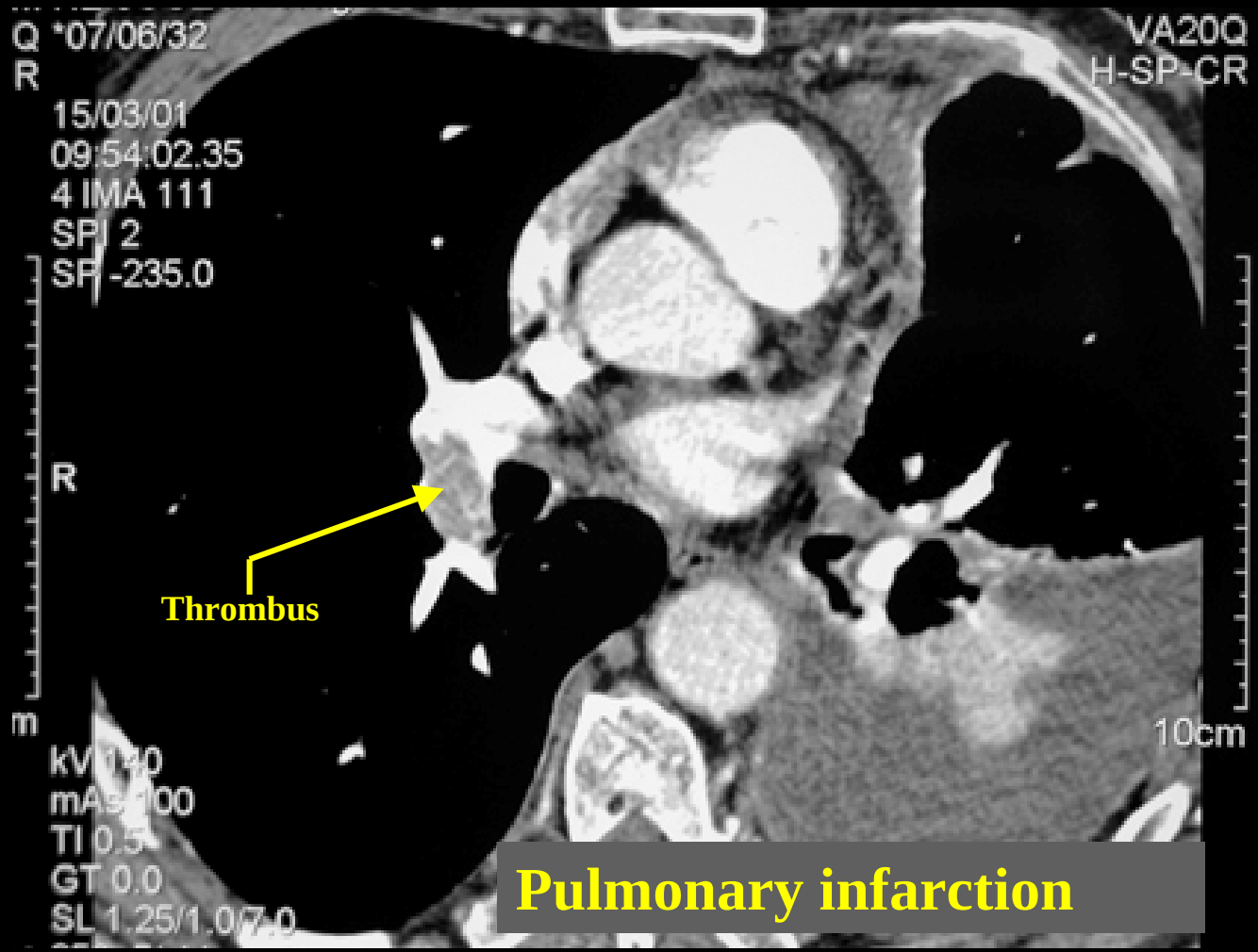

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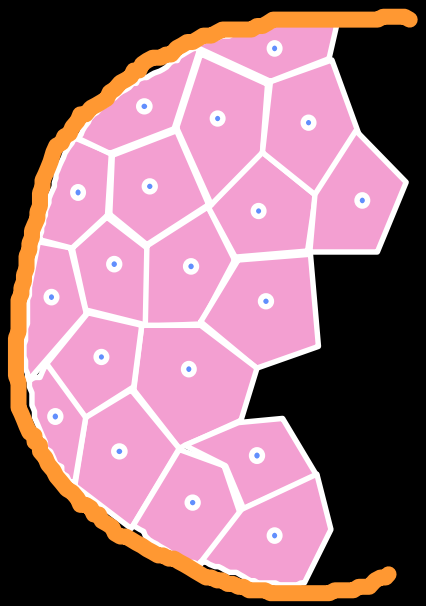
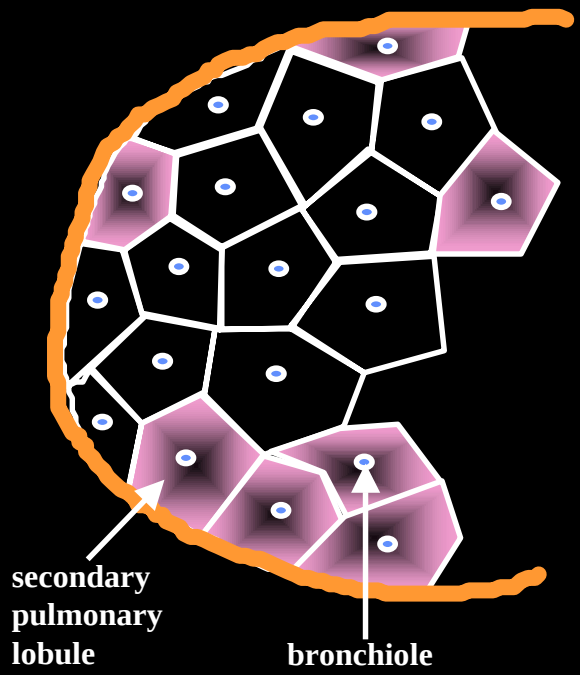
HISTOLOGIE: Particularités des Pneumonies nosocomiales

- ➔ foyers de bronchopneumonie dispersés
- ➔ le plus souvent bilatéral (16 / 21)
- ➔ predominant dans les segments déclives
- ➔ plus sévere dans les segments déclives





LOBAR PNEUMONIA

VAP = LOBULAR PNEUMONIA
bronchopneumonia

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HISTOLOGIE: Particularités des Pneumonies nosocomiales

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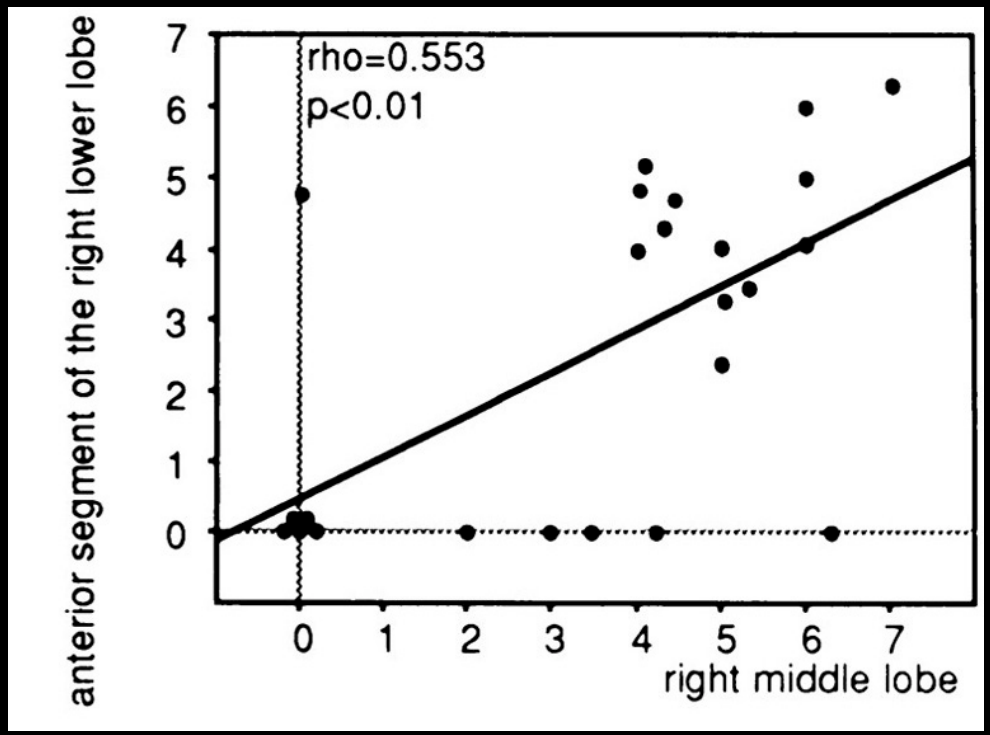

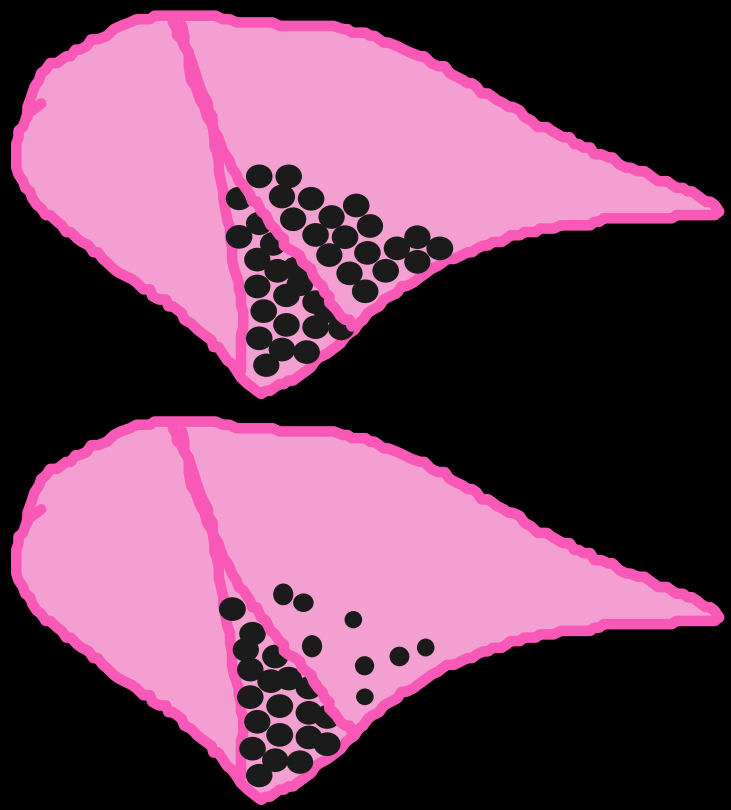

comparisons of the bacterial burden present in immediately adjacent areas of the lungs
Each symbol represents a single lung segment

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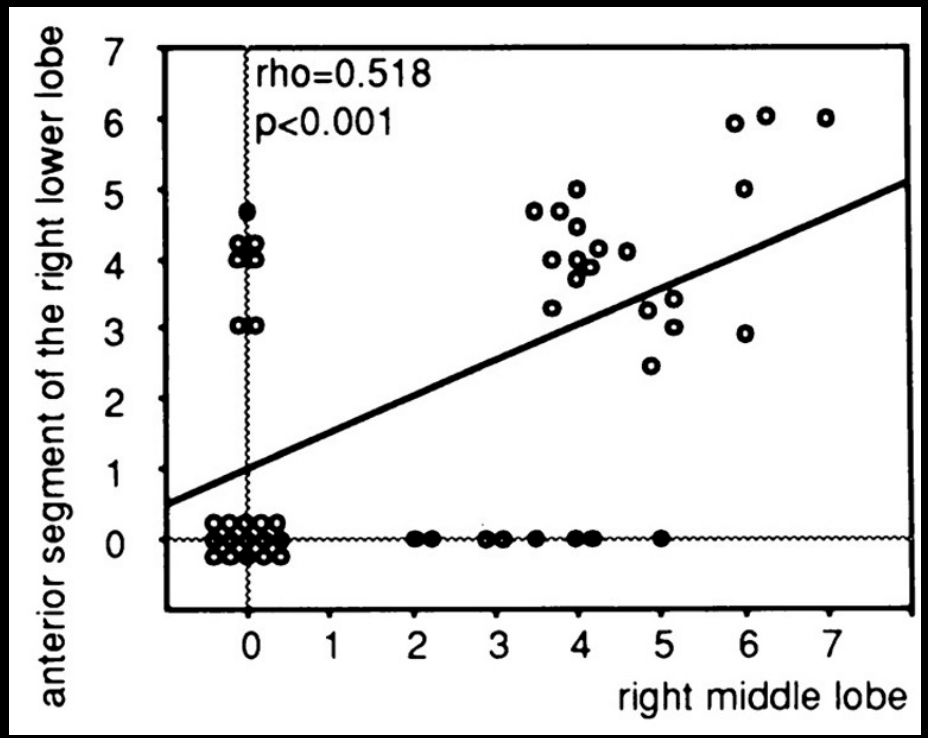

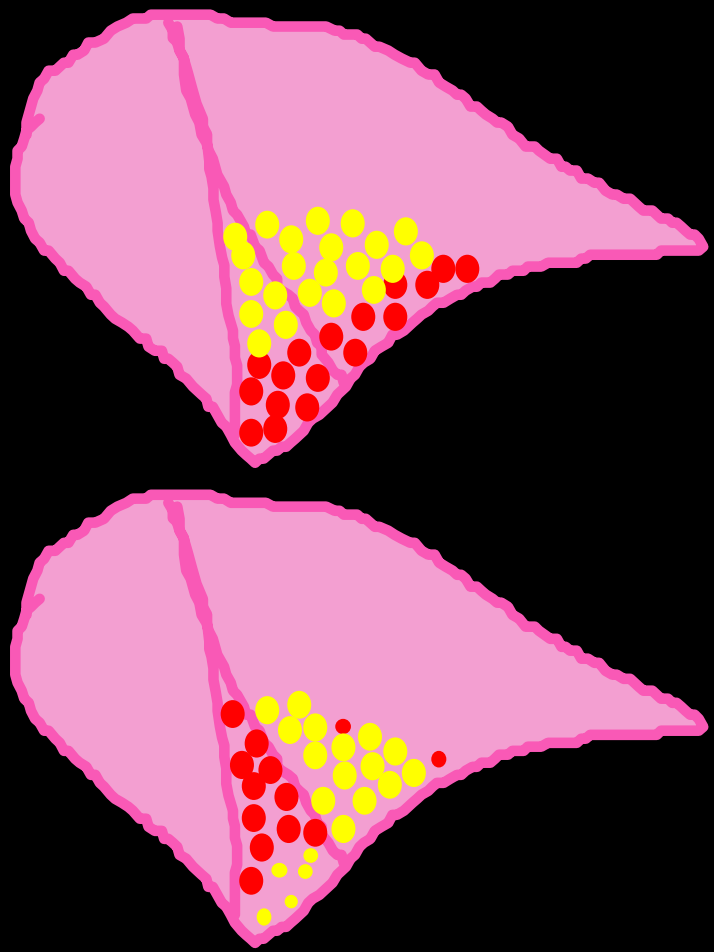

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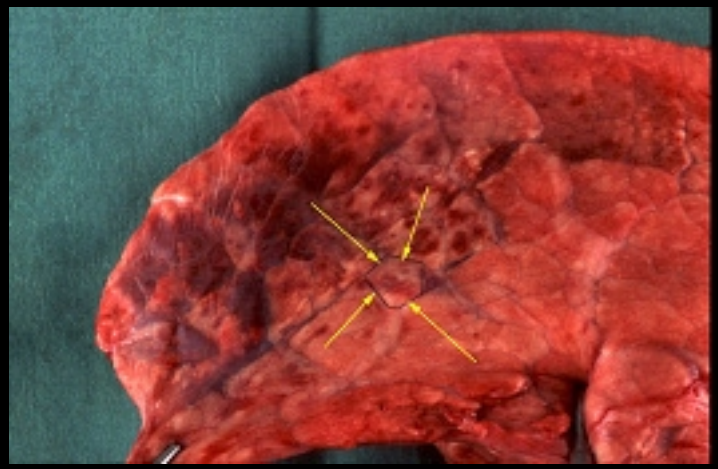

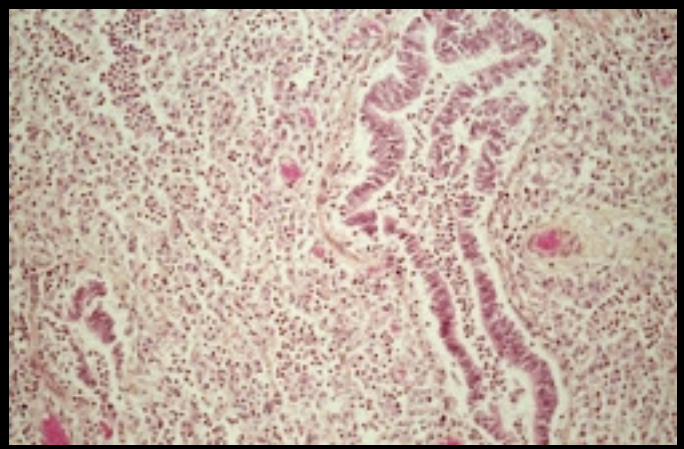

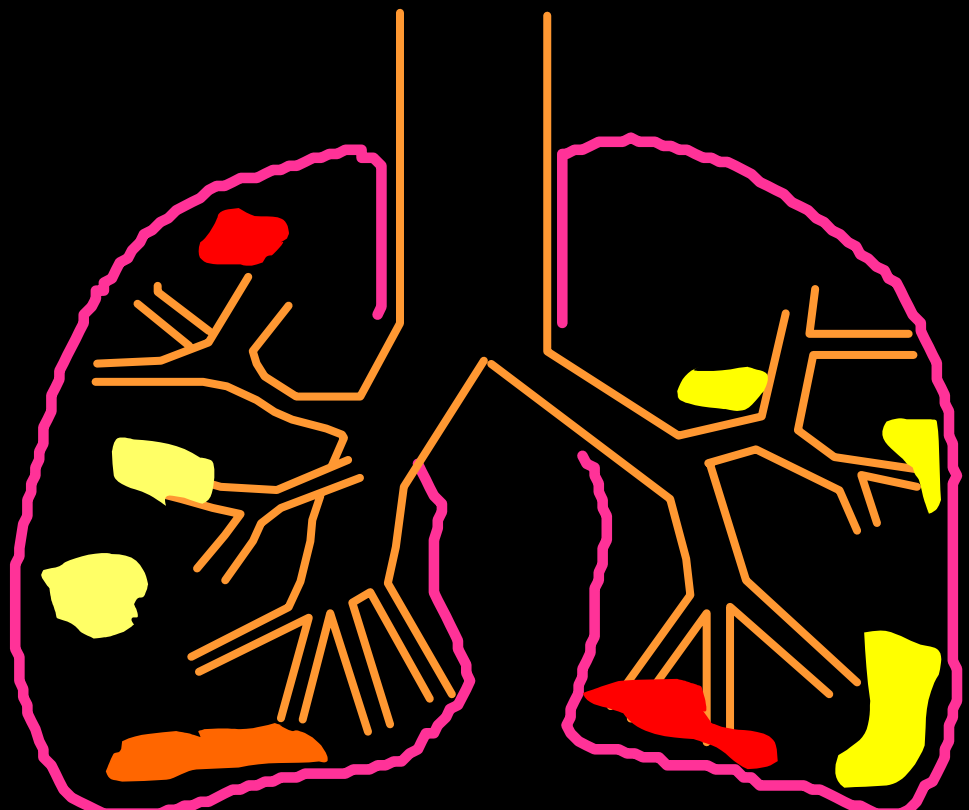

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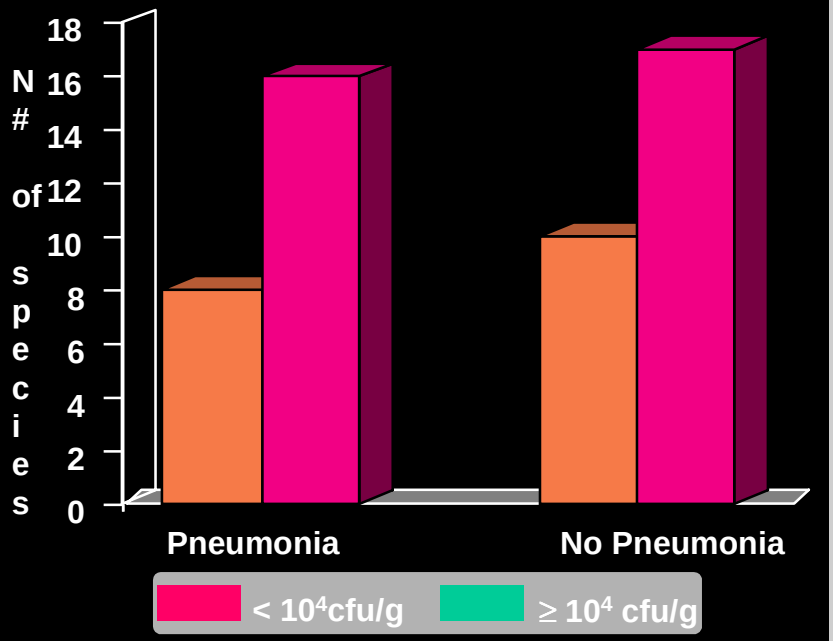
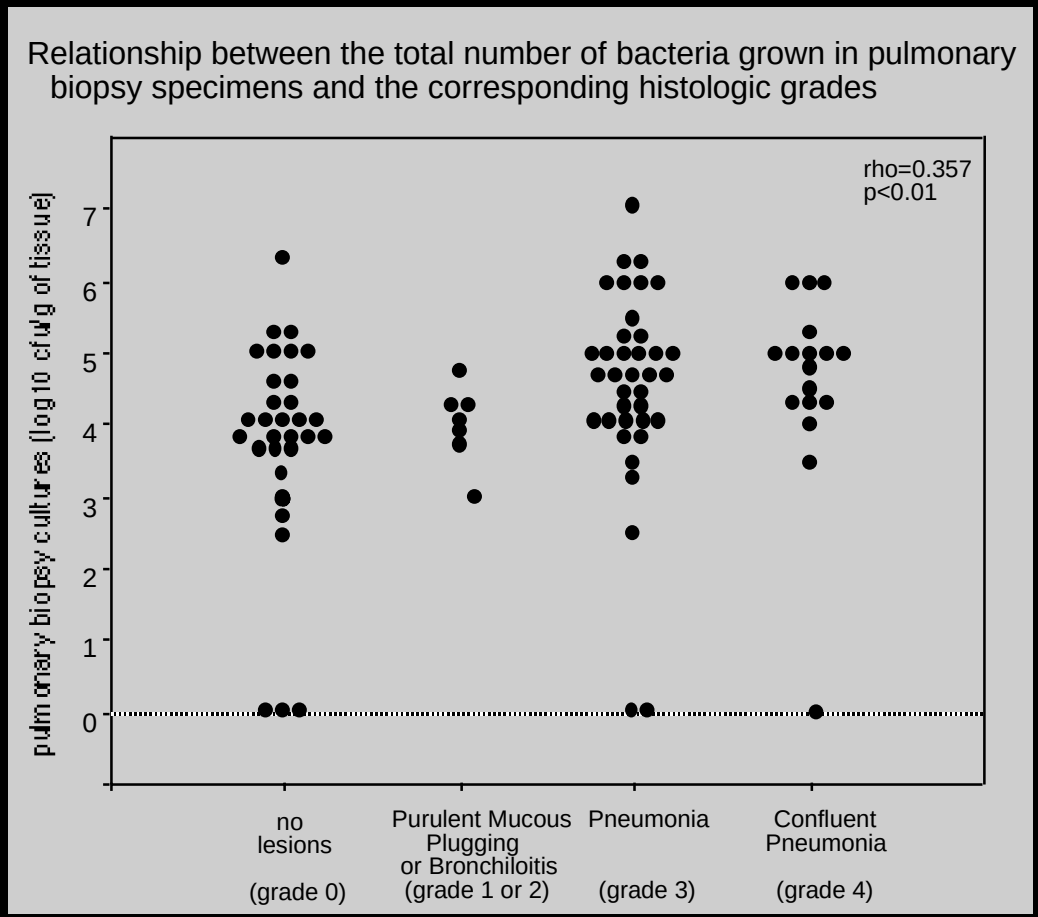
HISTOLOGIE: Particularités des Pneumonies nosocomiales

- Absence de relation linéaire entre les concentrations bactériennes dans le parenchyme et les lésions histologiques



Rouby *et al*, Am Rev Respir Dis 1992
Torres *et al*, Am J Respir Crit Care Med 1994

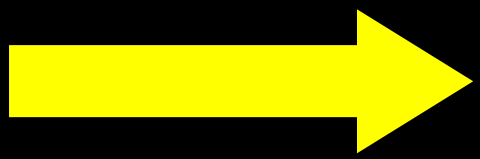


Marquette *et al*, AJRCCM 1998 & Chest 1999

Place des techniques invasives

the ideal situation when there is clinical suspicion of pneumonia

- Diagnostic strategy
  - quickly identifies the patients with VAP
    - I confidently start ATB
  - quickly provides reliable information regarding the causative organism
    - I choose the appropriate ATB



the appropriate treatment works

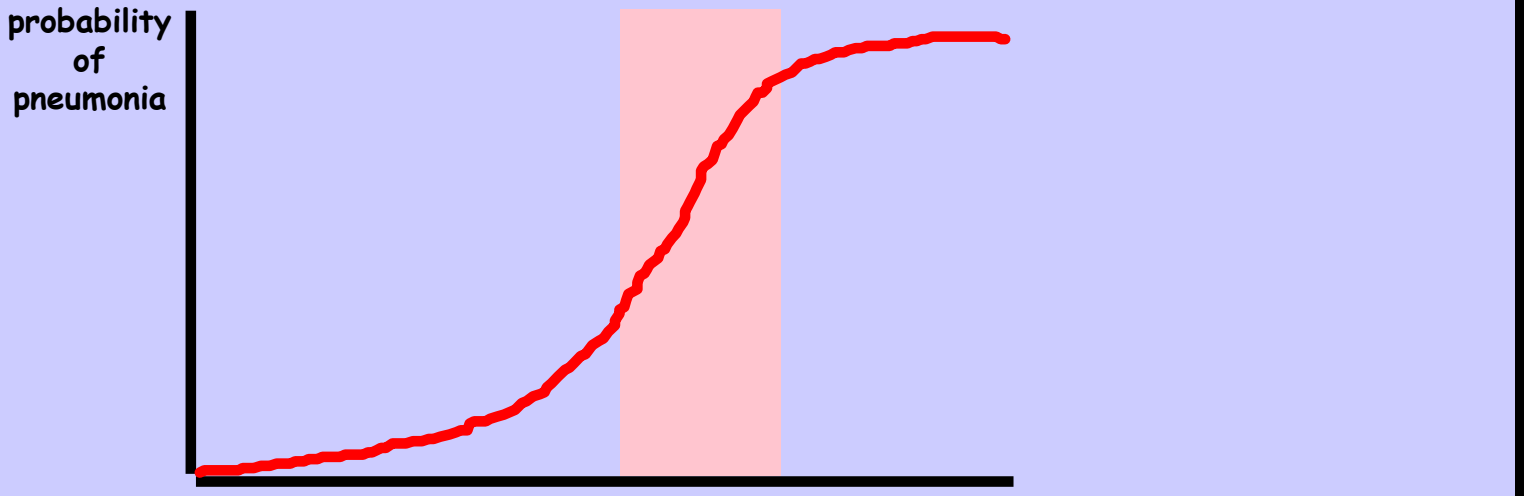
☞ the strategy is cost-effective

The *invasive* strategy

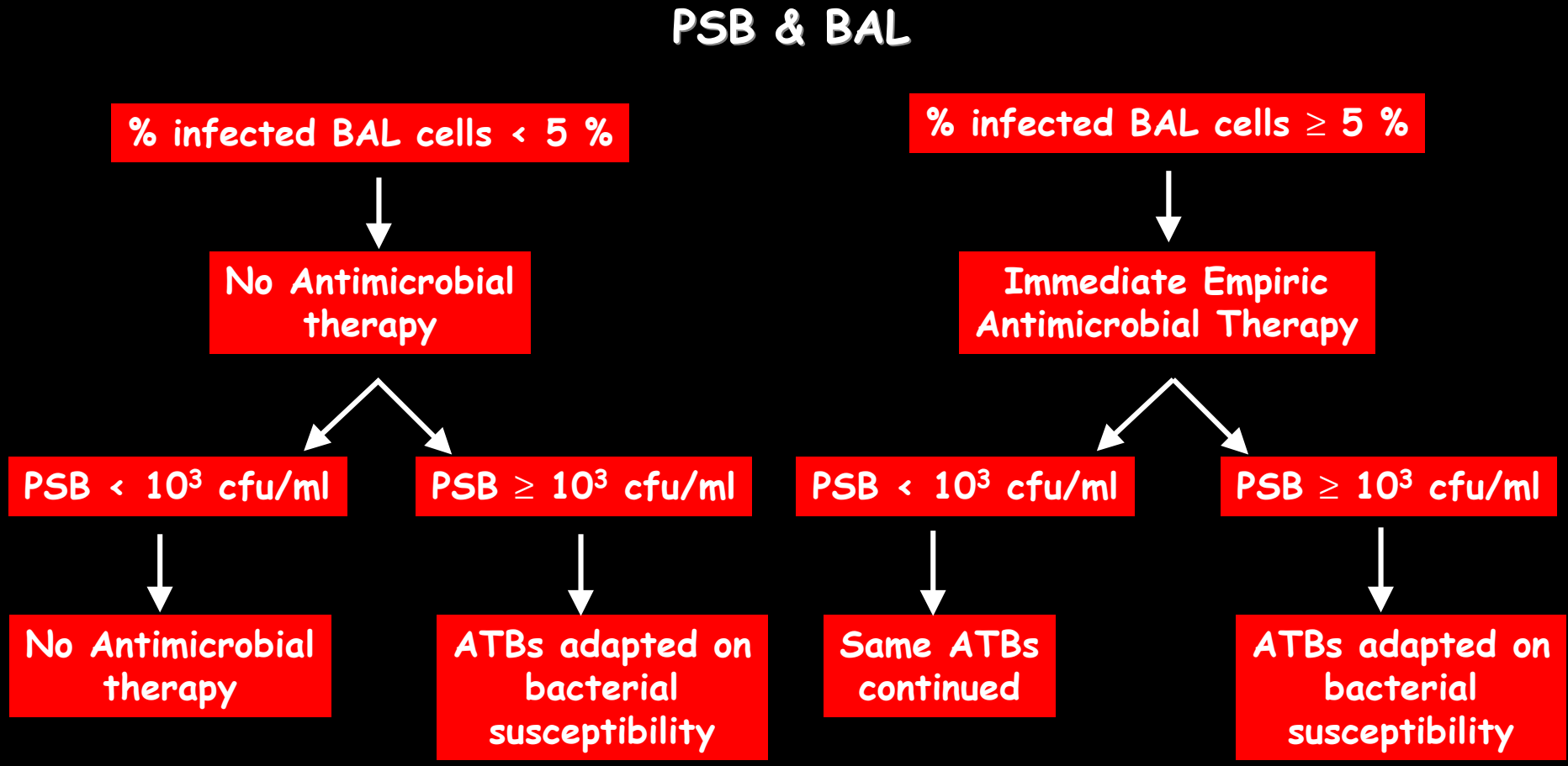
- clinical, radiological and biological signs are sensitive but <u>poorly specific</u>
- prior ATB could increase the mortality (selection of resistant organisms)

→ decision to treat based on bronchoscopic samples

quantitative cultures techniques applied to respiratory specimens tried to answer to the question by using "diagnostic cutoffs"



Clinical suspicion for VAP is the starting point of diagnostic evaluation



Chastre & Fagon
AJRCCM 1994

a patient with a clinical suspicion of pneumonia but negative microbiological results (PCB/BAL) does not receive antibiotics

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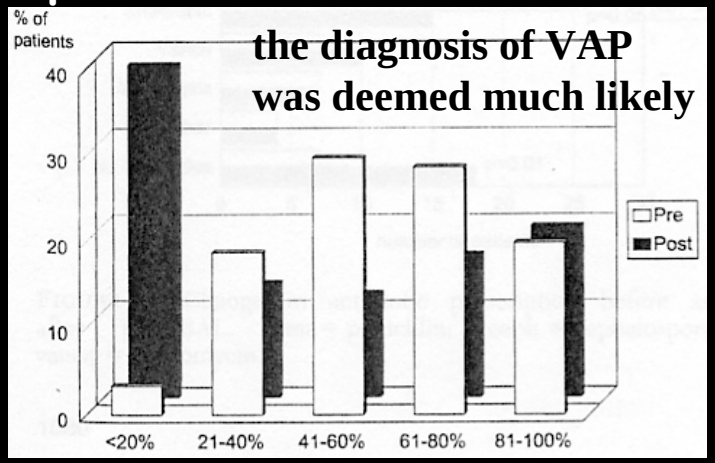
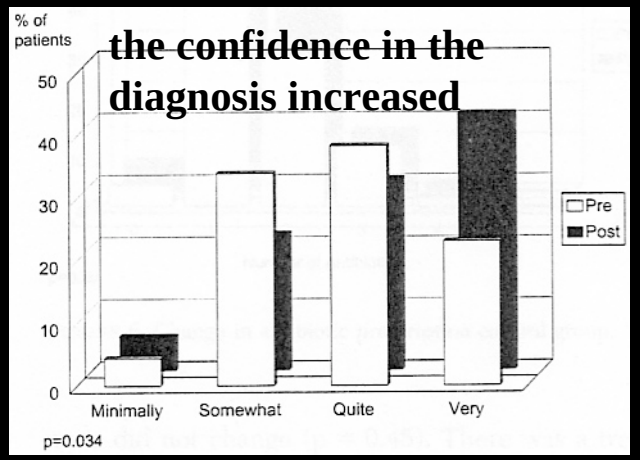
Does the physician feel confident with this way of doing ?

The clinical utility of invasive diagnostic techniques in the setting of VAP Heyland et al. Chest 1999

After bronchoscopy results became available, from the physician's perspective





- BUT in patients with no growth on PCB/BAL antibiotics were not discontinued (most of the time)
  - the physicians were not more confident in their diagnosis following bronchsocopy

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Operative values of quantitative cultures of PSB & BAL in the studies systematically referring to lung histology

	sensitivity		specificity	
	PSB*	BAL°	PSB*	BAL°
Torres (1994)	36 %	50 %	50 %	45 %
Marquette (1995)	58 %	47 %	89 %	100 %
Chastre (1995)	82 %	91 %	89 %	78 %
Papazian (1995)	42 %	58 %	95 %	95 %
Kirtland (1997)	33 %	11 %	88 %	80 %
Fabregas (1999)	62 %	77 %	75 %	58 %

* diagnostic cutoff : 10^3 cfu / ml
° diagnostic cutoff : 10^4 cfu / ml

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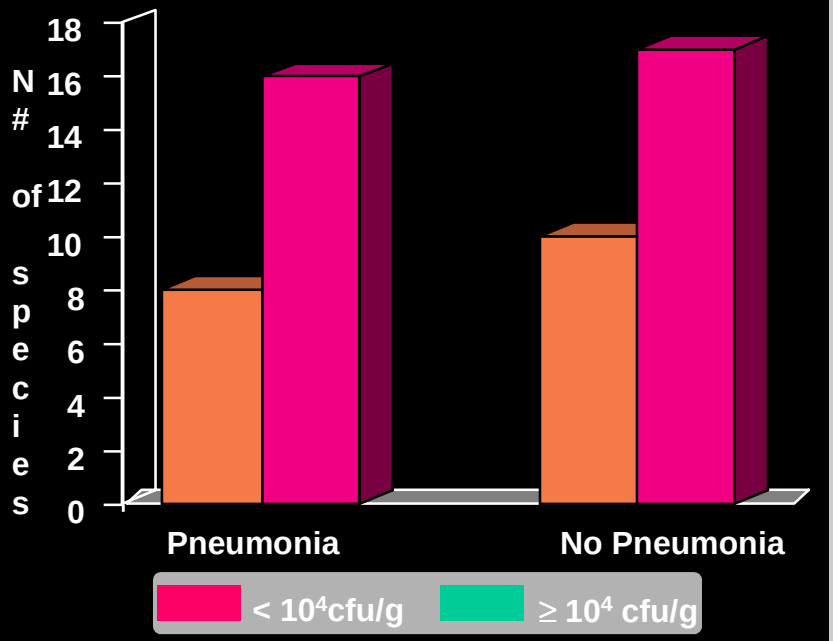
Why are sophisticated techniques such as PSB and BAL not able to confidently establish the diagnosis of pneumonia ?

- no straightforward relationship between bacterial concentrations in lung tissue and histological lesions



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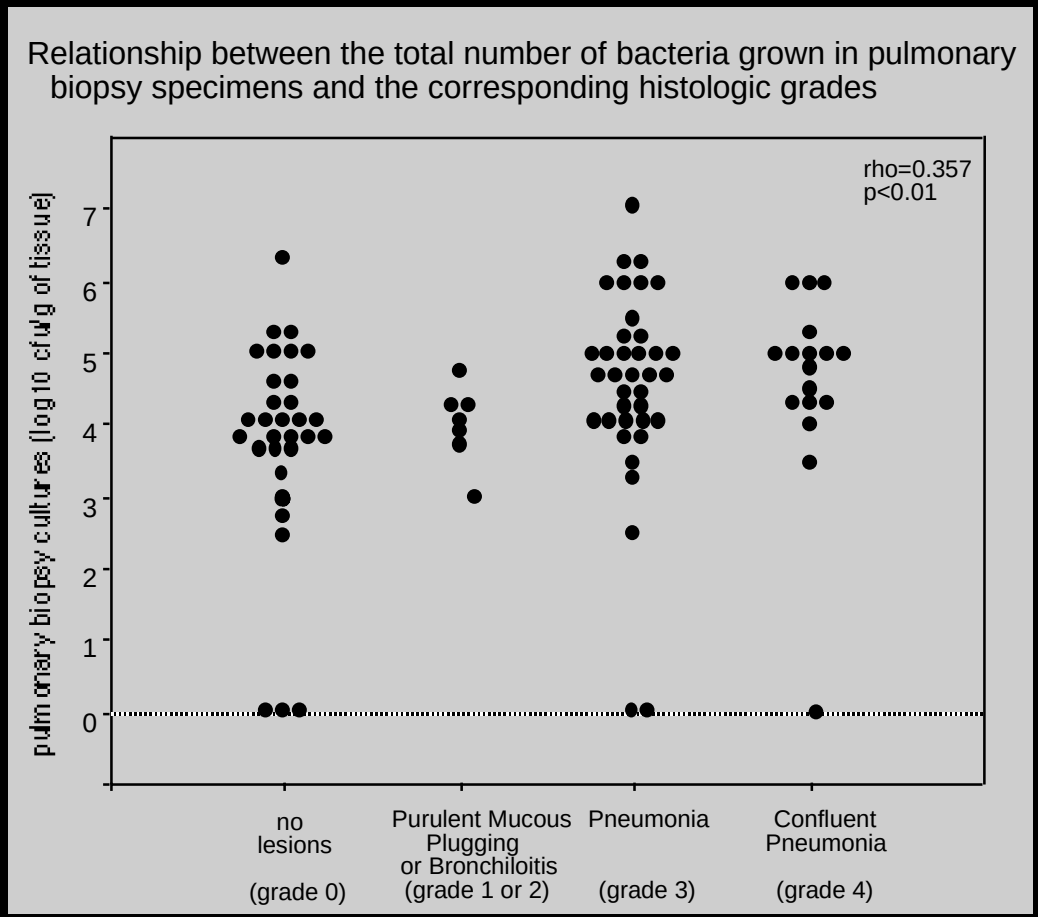

Marquette *et al*, AJRCCM 1998 & Chest 1999

Why are sophisticated techniques such as PSB and BAL not able to confidently establish the diagnosis of pneumonia ?

- Limits related to pneumonia
  - lesions are unevenly distributed through normal or damaged lung parenchyma
  - the bacterial burden is unevenly distributed through normal or damaged lung parenchyma
  - no straightforward relationship between bacterial concentrations in lung tissue and histological lesions

- Limits related to techniques
  - Chest X ray
  - Bronchoscopic techniques

- Limits related to clinical situation
  - Antibiotic therapy

Limits related to Chest X ray and Bronchoscopy

- Chest X ray hardly can identify where to place the fiberoptic bronchoscope for PSB and BAL ?
- Problems with repeatability of quantitative culture of PSB and BAL may change the therapeutic decision

  Marquette, ARRD 1993, Timsit, Chest 1993, Gerbeaux, AJRCCM 1998

second PSB \ first PSB	≥ 10^3 cfu/ml	< 10^3 cfu/ml
≥ 10^3 cfu/ml	14	4
< 10^3 cfu/ml	5	16

in 23 % of the cases (9/39) PSB gave opposite diagnostic information

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Limits related to clinical situation:Antibiotic therapy

- Diagnostic accuracy of PSB and BAL in VAP: Impact of previous antimicrobial treatments

Souweine et al. Crit Care Med 1998; 26: 236

	ICO Count[a]		BAL Culture[b]		PSB Culture[c]	
	Se	Sp	Se	Sp	Se	Sp
No antibiotic group	0.71	NP	0.71	NP	0.88	1
Current antibiotic group	0.50	1	0.83	0.91	0.77	0.91
Recent antibiotic group	0.67	1	0.38[d]	1	0.40[d,e]	1

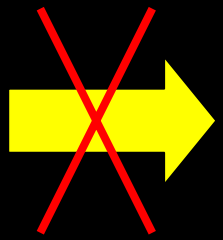
cfu, colony-forming units; NP, not performed.

[a]For 5% threshold; [b]for 10^5-cfu/mL threshold; [c]for 10^3-cfu/mL threshold; [d]$p < .05$ between the recent antibiotic group and the no antibiotic and current antibiotic groups combined; [e]$p < .05$ between the recent antibiotic group and the no antibiotic group.

The *non-invasive* strategy

Invasive strategy

- Limits related to pneumonia
- Limits related to techniques
- Limits related to clinical situation



quickly identifies the patients with VAP

Clinical suspicion for VAP is the starting point of evaluation

⇒ Comprehensive clinical work-up

- search for alternative causes of fever & Rx infiltrates
- use of a clinical score
  - CPIS (with a threshold of 6)
    - sensitivity: 72 % specificity: 85 %

Papazian. Am J Respir Crit Care Med 1995; 152: 1982-91

  - X-ray plus 2 criteria out of T ≥38°3, PMN ≥12000/L, purulent TB secretions sensitivity 69 %, specificity 75 %

Fabregas et al. Thorax 1999; 54:867-873

the ideal situation when there is clinical suspicion of pneumonia

- Diagnostic strategy
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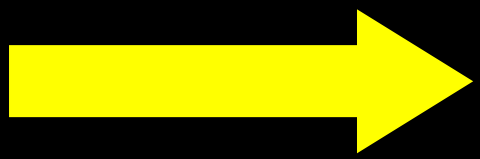
    - I confidently start ATB
  - quickly provides reliable information regarding the causative organism
    - I choose the appropriate ATB



the appropriate treatment works

The *invasive* strategy

Chastre (AJRCCM 1995)

- patients off antibiotics or had no recent changes in antibiotic therapy
- of the 32 microbial species present in lung at a concentration ≥ 10^4 cfu/g
- 29 (90%) were recovered by the PSB at a concentration ≥ 10^3 cfu/ml
- all were also present in BAL at concentrations ≥ 10^4 cfu/ml

Kirtland (Chest 1997)

	PSB	BAL	EA
sensitivity*	44	65	87
specificity*	81	63	31

* whetever the results of quantitative cultures

The *invasive* strategy

Ability of EA, PSB and BAL to identify the causative organism in the 21 animals with pneumonia (Marquette; Chest 1999, AJRCCM 1998)

	correct identification	total number of specimens	true positive rate (%)
PSB (diag threshold 10^3cfu/ml)	12	32	37 %
BAL (diag threshold 10^4cfu/ml)	16	32	50 %
EA (diag threshold 10^6cfu/ml)	13	17	76 %
(diag threshold 10^5cfu/ml)	16	17	94 %

causative organism(s) = organism(s) cultured at a concentration $\geq 10^4$ cfu/g in any of the pulmonary biopsy specimens

The *non-invasive* strategy

- first line antibiotics based on customized guidelines
  - customized for every country, region, hospital or department

- first line antibiotics based on endotracheal aspirates
  - taken as weekly survey
  - taken at the time of clinical suspicion
    - ensure direct examination of the sample
    - take into account the species growing $\geq 10^5$cfu/ml

The *non-invasive* strategy

- first line antibiotics based on epidemiological studies

(Trouillet Am J Respir Crit Care med 1998; 157: 531-39

	group 1 MV < 7 d ATB = no	group 2 MV < 7 d ATB = yes	group3 MV ≥ 7 d ATB = no	group 4 MV ≥ 7 d ATB = yes
organisms				
Multiresistant bacteria				
P aeruginosa		4 (20%)	2 (6%)	33 (22%)
A baumanii		1 (5%)	1 (3%)	20 (13%)
S maltophila				6 (4 %)
MRSA		1 (5%)	1 (3%)	30 (20%)
Other bacteria				
enterobacteriacae	(24 %)	(20%)	(22%)	(15%)
hemophilus spp	(20%)	(10%)	(3%)	(3%)
MSSA	(15%)		(22%)	(5%)
S pneumonia	(7%)			
other streptococci	(17%)	(25%)	(22%)	(9%)
Neisseria spp	(13%)	(10%)	(12%)	(2%)
other pathogens	(5%)	(5%)	(7%)	(8%)

- **VAP** (in patients with intermediate severity) **results**
  - ↗ morbidity
  - (↗ mortality)
- **invasive and non-invasive strategies have limits**
  - in identifying patients with pneumonia
  - in identifying the causative organisms

from a patient outcomes ' perspective

does a management strategy that combines clinical judgment with results from invasive diagnostic tests improve patient outcomes compared with clinical judgment alone or combined with non-invasive tests ?

Mortality & morbidity of VAP: impact of diagnostic tools

Timsit et al. AJRCCM 1996

387 pts, MV > 48h
NON randomized

		mortality
Suspected VAP	n = 112	58 %
Confirmed VAP	n = 56	57 %

PSB $\geq 10^3$ cfu/mL or BAL $\geq 10^4$ cfu/mL

→ In patients with suspected VAP invasive diagnostic methods adds no prognostic information

- This study was not designed to answer to this question
  - observational study design
  - bronchoscopy was not randomly allocated

Mortality & morbidity of VAP: impact of diagnostic tools

Heyland et al . AJRCCM 1999.

prospective matched cohort

to study the attributable morbidity & mortality of VAP in critically ill patients

part of the « sucralfate vs ranitidine trial » Cook et al. NEJM 1998

177 pts / 164 matched controls

matching criteria: same diagnosis, age, APACHE score, prior lenght of exposure (MV days), med/surg, MOD, score day -1

diagnosis of VAP: clinical

the effect of the diagnosis strategy was explored:

- **clinically suspected (bedside intensivist)**
- **adjudication committee**
- **positive PCB or BAL**

→ the the attributable morbidity & lenght of stay were the same in patients with **clinically suspected pneumonia** and patients with a **bacteriologically confirmed diagnosis**

- **This study was not designed to answer to this question**

Mortality & morbidity of VAP: impact of diagnostic tools

The clinical utility of invasive diagnostic techniques in the setting of VAP
Heyland et al. Chest 1999

92 pts with clinical suspicion of VAP with bronchoscopy

49 pts with clinical suspicion of VAP without bronchoscopy

part of the study on attributable morbidity & mortality of VAP in critically ill patients (177 pts / 164 matched controls)

part of the « sucralfate vs ranitidine trial » Cook et al. NEJM 1998

« - there was a lower mortality in the group that underwent bronchoscopy (18.5 % vs 34.7 %, p=0.03) compared with those patients in the control group »

- This study was not designed to answer to this question
  - observational study design
  - bronchoscopy was not randomly allocated
  - 23 % of the patients in the control group did not undergo bronchsocopy because they were considered too unstable

Mortality & morbidity of VAP: impact of diagnostic tools

Sanchez-Nieto et al. AJRCCM 1998; 157: 371-376

51 pts, MV > 72 h, randomized to:

		adjusted mortality	
Group A (PSB, BAL QEA)	n = 24	29 %	
Group B (QEA)	n = 27	10 %	NS

no difference in ICU stay & duration of MV

In this pilot study, the impact of bronchoscopy was to lead to more frequent ATB changes, with no change in mortality

- trauma accounted for > 50 % of causes for admission
- the incidence of *Pseudomoas* and *Acinetobacter* was significantly different between the 2 groups
- ATB were continued in all patients despite negative cultures

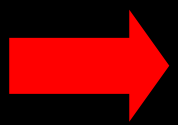
Mortality & morbidity of VAP: impact of diagnostic tools

Sole Violan et al . Crit Care Med 2000

91 pts, MV > 48 h, randomized to:

		mortality	
Group A (31 PCB, 28 BAL, 14 PBAL)	n = 45	22.2 %	
Group B (nQEA)	n = 43	20.9 %	NS

no difference in ICU stay & duration of MV



the impact of bronchoscopy was to lead to more frequent ATB changes, with no change in mortality

- trauma accounted for 35 % of causes for admission
  - *H. influenzae* and MSSA accounted for > 50 % of the causative organisms
- the incidence of Pseudomoas was significantly different between the 2 groups (10 in Group A and 3 in Group B)
- ATB were continued in all patients despite negative cultures

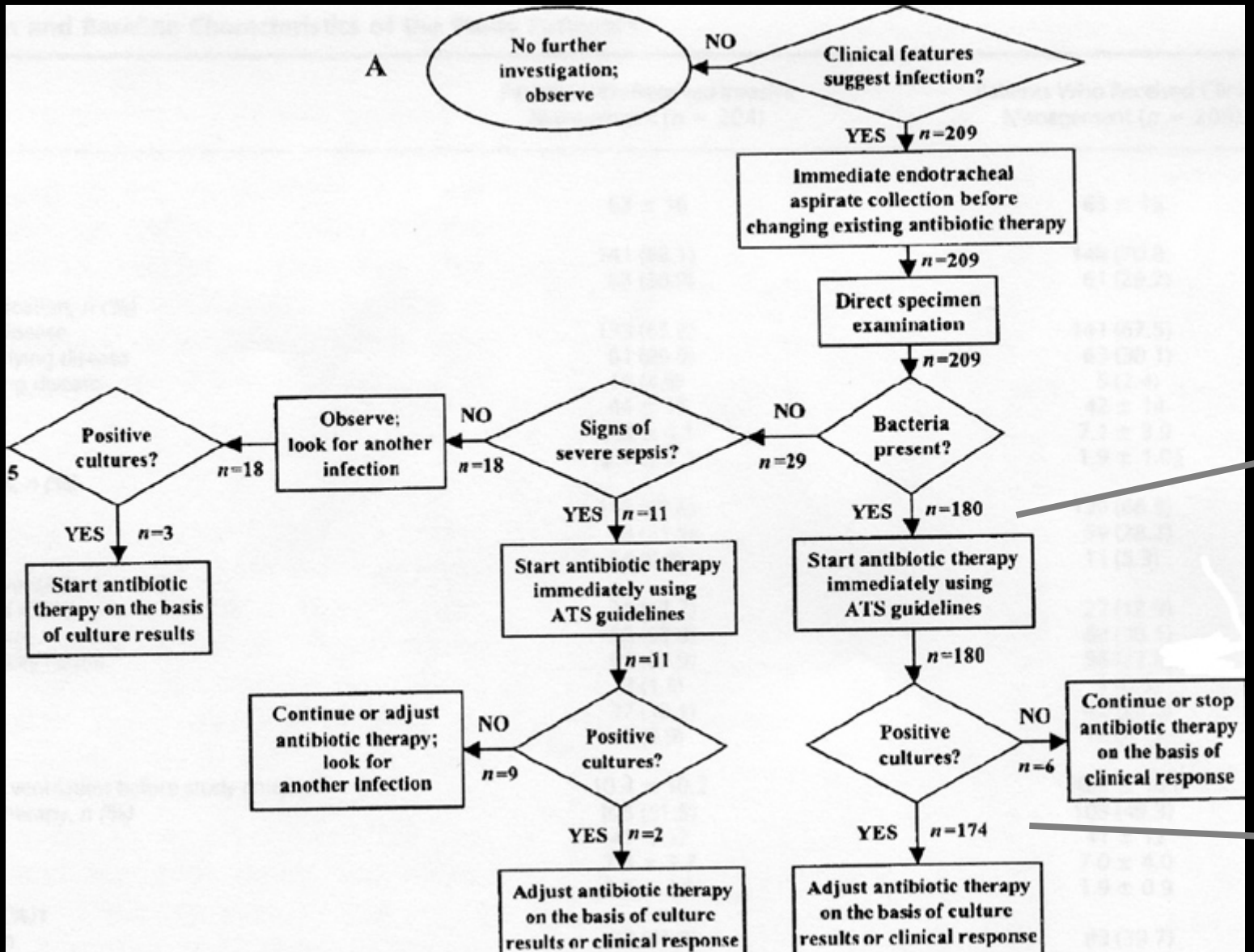
Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630

- 413 pts out of 31 ICUs
- clinical management
  - clinical evaluation
  - direct examination and non-quantitative cultures of endotracheal aspirates
- invasive management
  - clinical evaluation
  - direct examination and quantitative cultures of PCB and or BAL
- the target sample size (400 pts): to detect a reduction from 30 % (clinical) to 20 % (invasive), power 80 %, confidence level 95 %
- definition of microbiologically comfirmed pneumonia
  - invasive: PSB$\geq 10^3$ / BAL $\geq 10^4$ / ICO $\geq$ 5%
  - clinical: TBAS positive

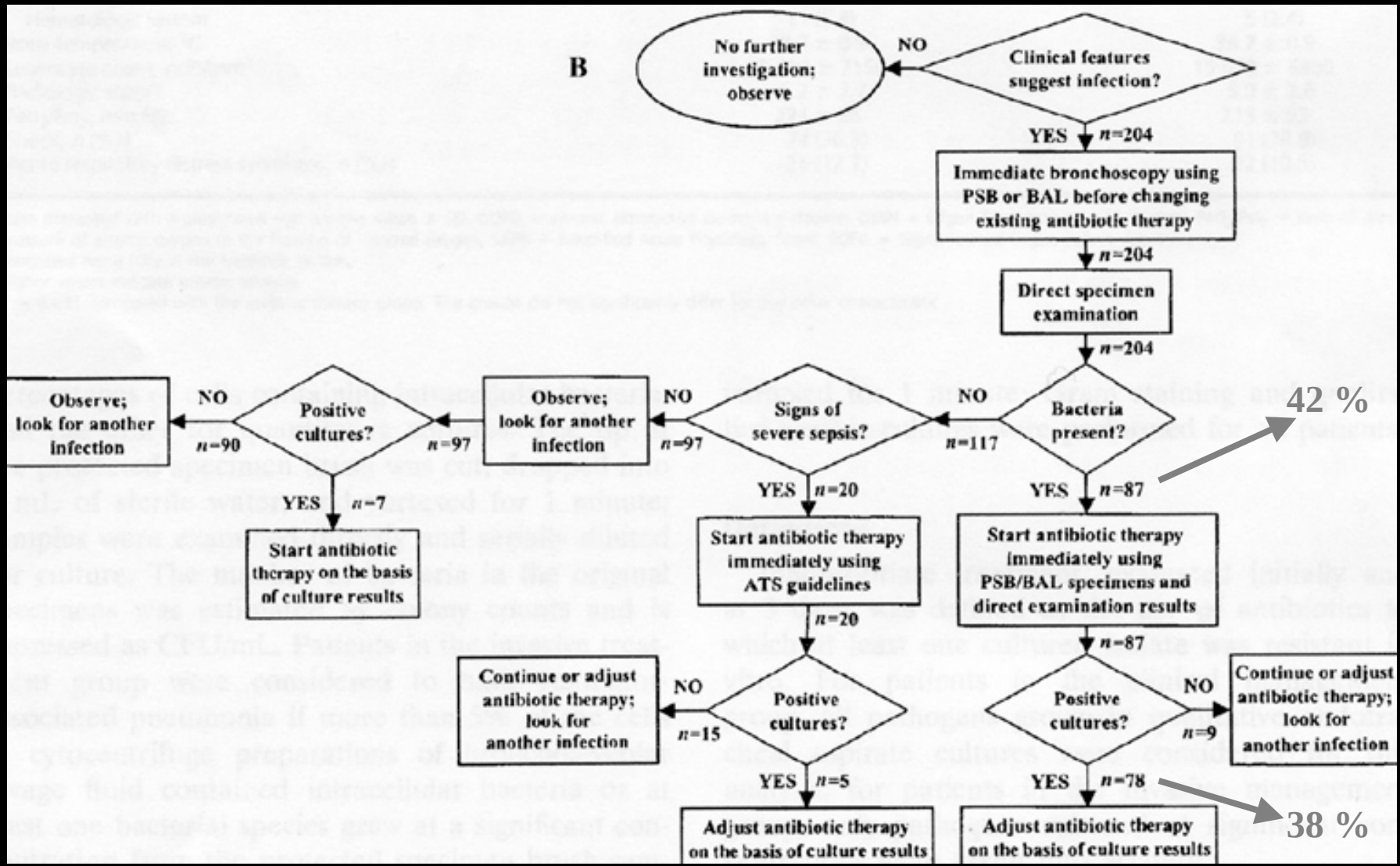
Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630



Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630



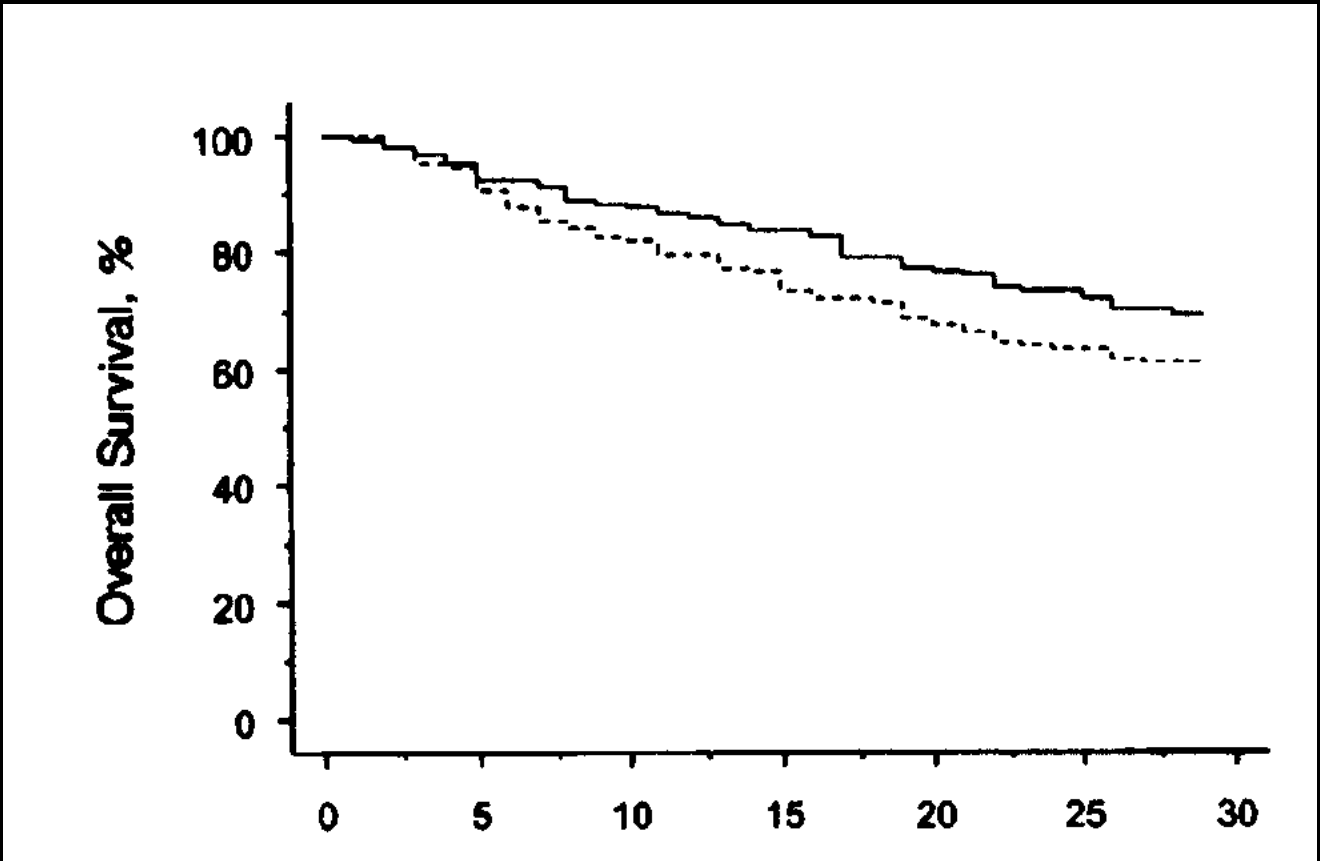
Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630

	Invasive	Clinical	difference	p value
Primary end points				
Mortality D14	33 (16.2)	54 (25)	-9.6	0.02
Day 3				
SOFA score (0-24)	6.1	7	-0.9	0.03
ODIN score (0-7)	1.7	1.9	-0.2	0.01
Day 14				
SOFA score (0-24)	3.9	4.3	-0.4	NS
ODIN score (0-7)	1.2	1.2	-0.03	NS
ATB free days D14	5	2.2	2.8	<0.001
Secondary end points				
Mortality D28	63)	81 ( )	-7.9	
ATB free days D28	11.5	7.5	-3.9	<0.001
MV free days	7.8	7	1.5	NS
ICU stay (days)	19.3	17.6	1.5	
hospit stay (days)	26.7	25.1	1.6	
emergence of resist bacteria	125 (61.3)	125 (59.8)	1.5	

Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630



Actuarial 28-D survival among 413 pts assigned to the invasive (solid line) or clinical (dashed line) management (p=0.07 between groups [log-rank test])

Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630

Comments

- Multicenter study: 413 pts out of 31 ICUs.
- Are these patients representative ?
  - 0.7 patient per month per ICU !!!!
  - Severity ???
    - SOFA score (0-24): 7.8
    - ODIN score (0-7) 2.1
    - SAPS II score (0-174) 44
- Relevant difference in observed mortality ?
  - 9% difference observed at D14 (p=0.02), the end of ATB therapy
  - whatabout adjusted mortality ?
  - no difference in actuarial 28-D survival

Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630

Explanations for the lower mortality rate

- ATB inappropriate in the non-invasive group ?
  - ATB inappropriate non-invasive 24 pt
    invasive 1 pt
    mortality 32 %
  - ATB appropriate mortality 20 %

NS

Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630

Explanations for the lower mortality rate

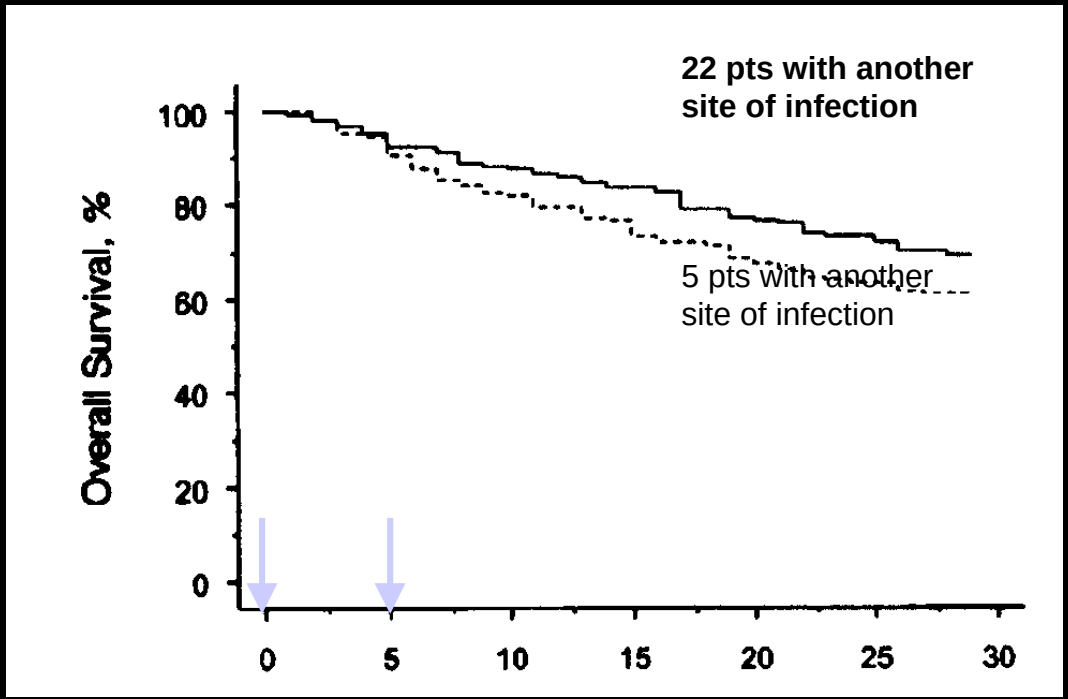
- less ATB ?
  - Avoids harmful side effects of ATB
  - reduces selection pressure
  - reduces superinfection with resistant bacteria
    - ATB free days at D28: 11.5 vs 7.5 (-3.9 Days, p<0.001)
    - among the 97 pts who did not receive ATB initially (invasive strategy), 86 % were on ATB on day 28
    - emergence of resistant bact. 61.3 vs 59.8 % (NS)

Invasive vs non-invasive strategy

Fagon& Chastre. Ann Intern Med 2000; 132:621-630

Explanations for the lower mortality rate

- Miss alternative sites of infection ?
  - The major benefit of a negative bronchoscopy specimen is to pay attention to alternative sources of infection



Invasive vs non-invasive strategy

Ruiz & Torres. AJRCCM 2000; 62:119-125

- design
  - 74 consecutive pts, 1 center, (4.5 pts/month)
  - detect a reduction from 40 % (clinical) to 10 % (invasive), power 80 %, confidence level 95 %
    - 413 pts out of 31 ICUs. (0.7 pts / month/ ICU)
    - detect a reduction from 30 % (clinical) to 20 % (invasive), power 80 %, confidence level 95 %
- definition
  - microbiologically confirmed pneumonia
    - invasive: PSB $\geq 10^3$ / BAL $\geq 10^4$ / ICO $\geq 2\%$
    - clinical: TBAS $\geq 10^5$
    - invasive: PSB$\geq 10^3$ / BAL $\geq 10^4$ / ICO $\geq 5\%$
    - clinical: TBAS positive

Invasive vs non-invasive strategy

Ruiz & Torres. AJRCCM 2000; 62:119-125

- after sampling all pts received empiric ttt (ATS)
- modifications based on ICO and TBAS, PSB or BAL cultures
- no stop of ATB if clinical suspicion of VAP persisted (even when cultures negative or non-significant)
- ttt failure: at least one of
  - T°=38° C or <35° C and purulent secretions
  - Rx spread
  - devpt of shock or MOF (score)
  - death caused by pneumonia
- in case of ttt failure:
  - search for other source of infection
  - reassessement with the same technique

Invasive vs non-invasive strategy

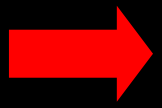
Ruiz & Torres. AJRCCM 2000; 62:119-125

results

- microbiologically confirmed pneumonia (Diag yield)
  - non-invasive 59 %
  - invasive 62 % (NS)
    - non-invasive 86 %
    - invasive 40 %

OUTCOME	non-invasive	invasive	
crude (mort 30 days)	46 %	38 %	NS
attributable	56 %	71 %	NS
adjusted	16 %	11 %	NS
ICU stay	21+/-18	21+/-15	NS

does a management strategy that combines clinical judgment with results from invasive diagnostic tests improve patient outcomes compared with clinical judgment alone or combined with non-invasive tests ?



NO

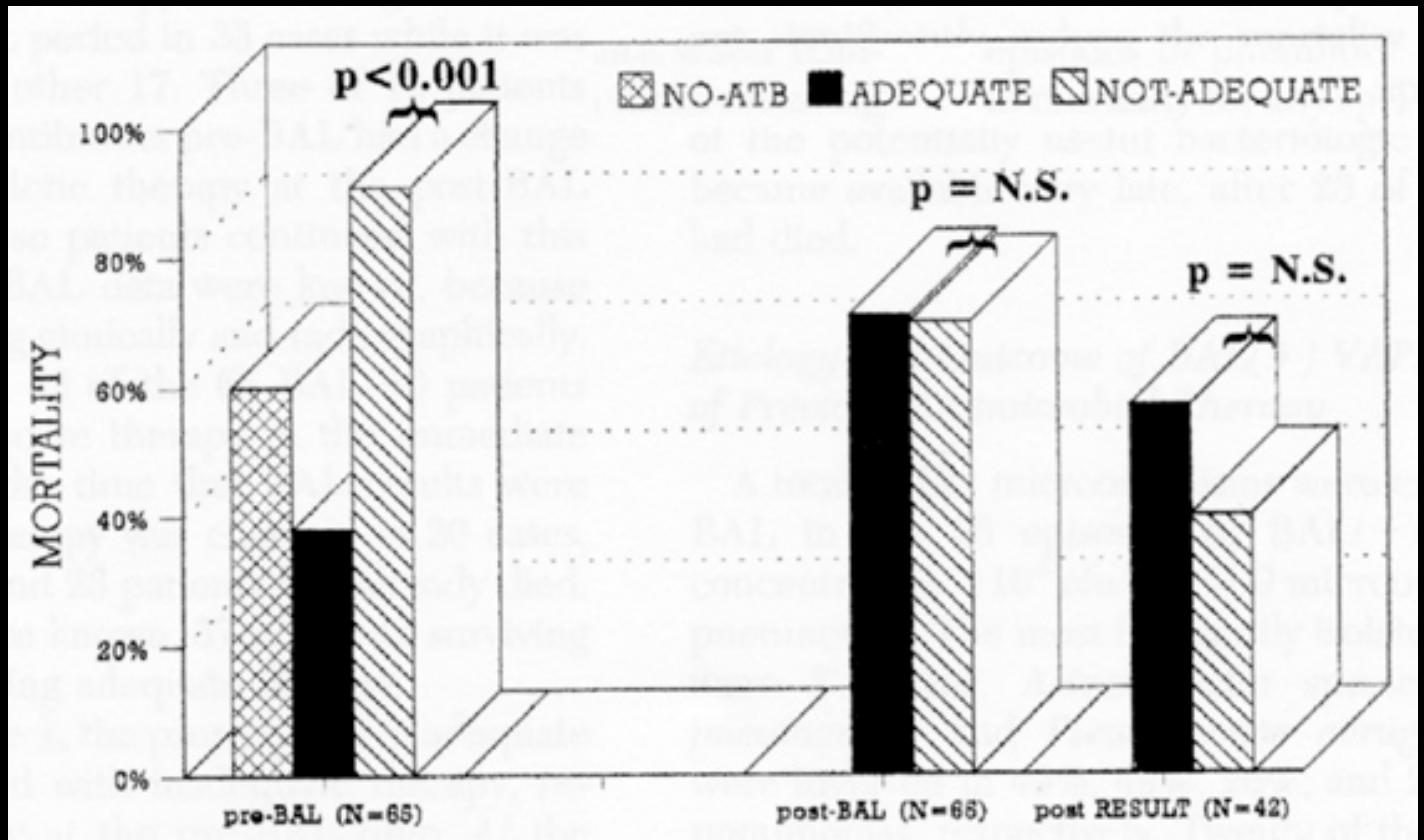
- invasive techniques have incremental costs
  - very few physicians feel comfortable enough to discontinue therapy in case of negative cultures
  - even when ATB are initially whithold, many patients end with ATB
- these techniques are not readily available on the field
- the diagnostic strategy may not be <u>the</u> key factor for outcome in VAP

Ch Marquette

Impact of BAM data on the outcome of VAP

Luna et al. Chest 1997

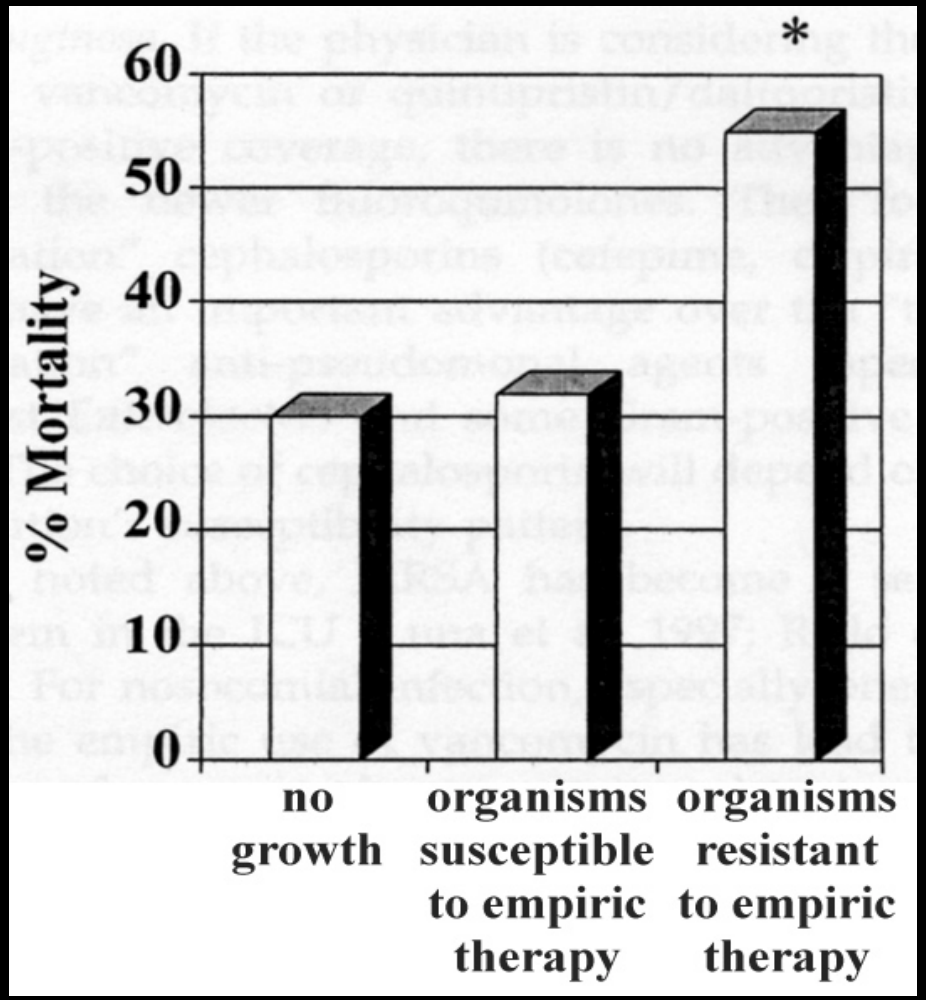
even if bronchoscopy can accurately define the microbial etiology of VAP, the information becomes available to late to influence survival



Influence of mini-BAL cultures on patient outcomes

Kollef et al. Chest 1998

ATB selection prior to obtaining the results of lower airway cultures is an important determinant of outcome for patients with suspected VAP

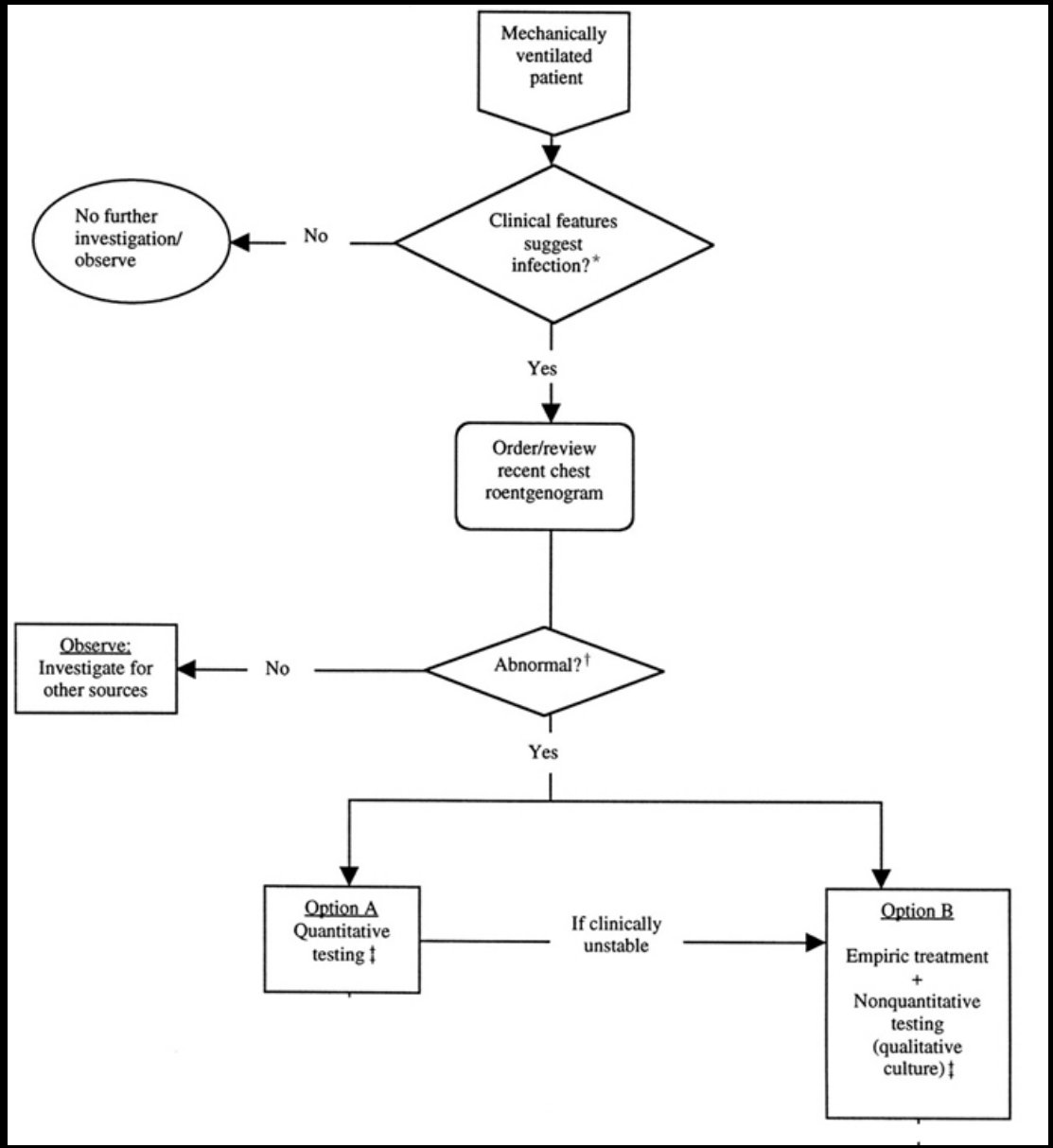


CONCLUSION 1

- invasive techniques are poorly sensitive to establish the diagnosis of VAP.
  - decision making algorithms recommending to withold antibiotic therapy in patients with negative results, entails a noticeable risk of undertreating patients with true pneumonia

- prospective randomized trial comparing invasive and non invasive approaches show no clearcut improve (survival or other meaningful end points such as antimicrobial resistance, antibiotic complications, or costs)

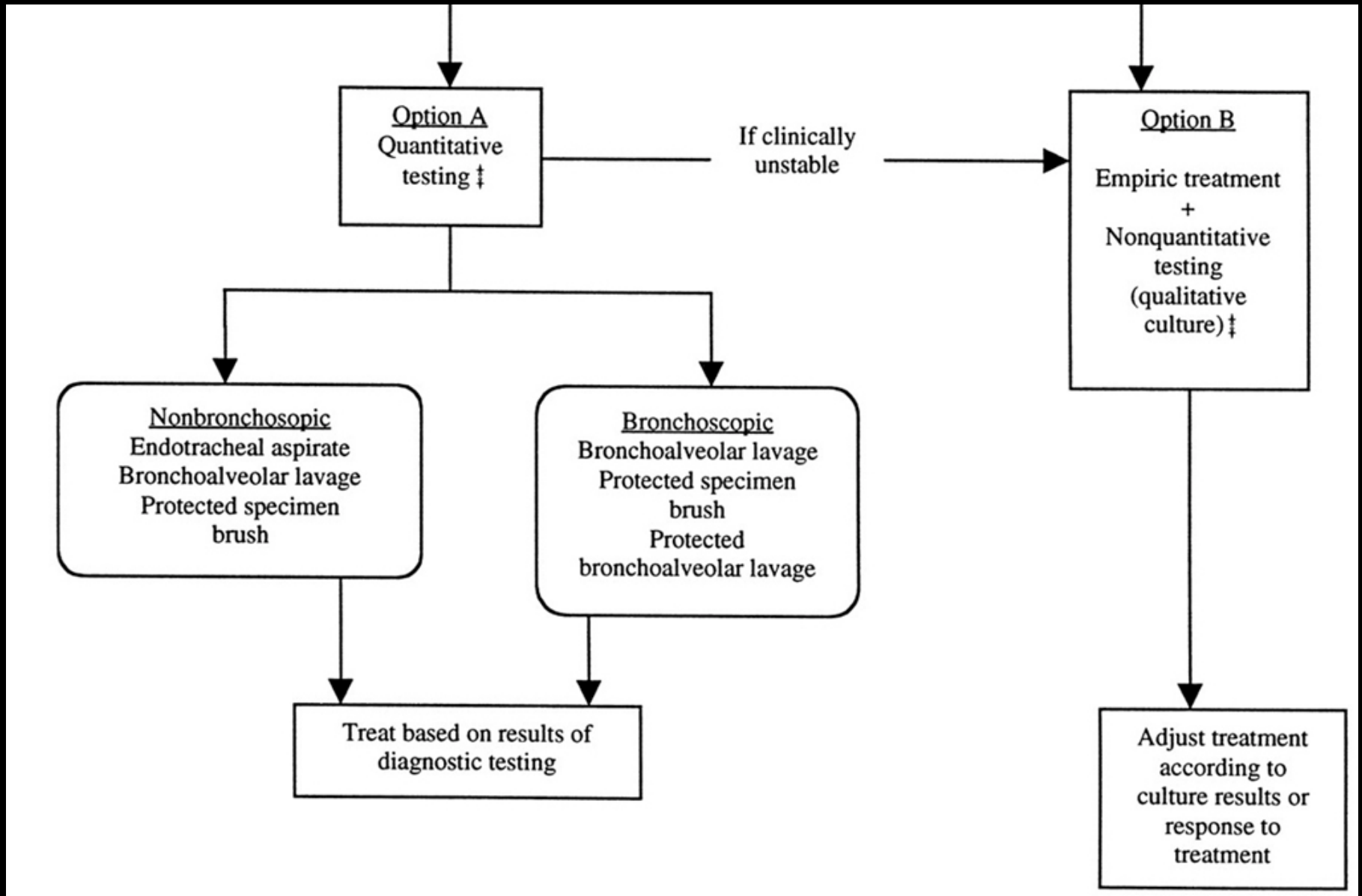
CONCLUSION 2



Evidenced based assessment of diagnostic tests for VAP

Grossman. Chest 2000;117:177S

CONCLUSION 3



Grossman. Chest 2000;117:177S

CONCLUSION 4 for clinical practice

- comprehensive clinical approach to decide whether to start ATB or not
  - use of a clinical score X-ray plus 2 criteria out of T ≥38°3, PMN ≥12000/L, purulent TB secretions
  - search for alternative causes of fever & Rx infiltrates

- first line antibiotics based on
  - customized guidelines
    - customized for every country, region, hospital or department
  - endotracheal aspirates
    - taken as weekly survey
    - taken at the time of clinical suspicion
      - ensure direct examination of the sample
      - take into account the species growing ≥ 10^5cfu/ml