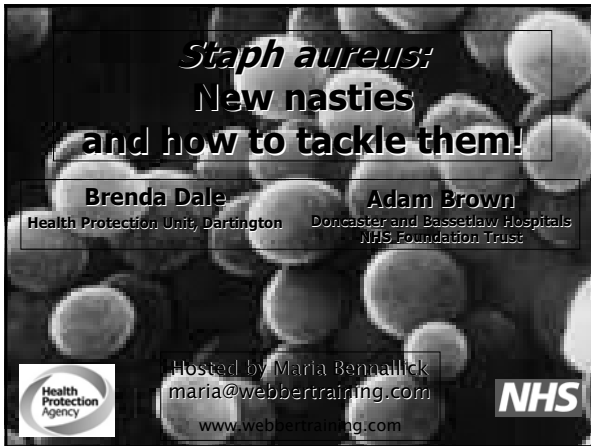


# PVL Producing *Staphylococcus aureus*

Brenda Dale & Adam Brown

A Webber Training Teleclass



***Staph aureus:***  
**New nasties**  
**and how to tackle them!**

**Brenda Dale**  
Health Protection Unit, Dartington

**Adam Brown**  
Doncaster and Bassetlaw Hospitals  
NHS Foundation Trust

Hosted by Maria Bernallick  
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Health Protection Agency

NHS



**SUN INVESTIGATION**

# NHS KILLER BUG SHOCK

**We find 80 times danger level of MRSA in hospital**

EXCLUSIVE by ANTHONY FRANCE  
LIFEY found the highest level of killer MRSA were found at an NHS hospital in a week. An independent reporter took samples while working at the North Staffordshire in Lichfield, North Staffordshire - named a year on the day it was first identified in 2006. Blood tested at home in

Continued on Page Four

May 2005



**DAILY EXPRESS**  
The World's Greatest Newspaper

# NEW BUG THAT KILLS IN HOURS



# RECRUIT DIED OF INFECTION



**Call to raise awareness of killer toxin**

## Overview

- What is PVL and how does it work?
- What is the situation in the SW of England?
- Experiences of managing this in the real world.
- What about MRSA?
- Are we all doomed?

## Virulence Factors

*Products that enable a bug to establish itself on or within a host, and enhance its potential to cause disease.*

Hosted by Maria Bernallick maria@webbertraining.com

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Page 1

# PVL Producing *Staphylococcus aureus*

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## Staphylococcal Toxins

- Help to modulate pathogenicity
- Wide selection that do different things:
  - Enterotoxins: Food Poisoning
  - TSST: Toxic Shock Syndrome
  - Haemolysins: Enable bug to feed off host (and others) (haemolysis)
  - PVL: Toxic to leucocytes

## Panton-Valentine Leucocidin

- Synergohymenotrophic toxin
- Gamma haemolysin (~100% strains)
- PVL (2 %strains)
- Bi- component toxin, can share subunits with Gamma haemolysin
- Spectrum of hybrid toxins

## PVL – Haemolysin Hybrids

	Class F	Class S
Gamma hemolysin	Hlg-B	Hlg-A Hlg-C
PVL	Luk-F	Luk-S

<table style="width: 100%;"> <tr><td style="text-align: center;">Luk-F + Luk-S (PVL)</td></tr> <tr><td style="text-align: center;">Luk-F + Hlg-A</td></tr> <tr><td style="text-align: center;">Luk-F + Hlg-C</td></tr> <tr><td style="text-align: center;">Hlg-B + Luk-S</td></tr> <tr><td style="text-align: center;">Hlg-B + Hlg-A</td></tr> <tr><td style="text-align: center;">Hlg-B + Hlg-C (Gamma hemolysin)</td></tr> </table>	Luk-F + Luk-S (PVL)	Luk-F + Hlg-A	Luk-F + Hlg-C	Hlg-B + Luk-S	Hlg-B + Hlg-A	Hlg-B + Hlg-C (Gamma hemolysin)	<p>Hlg-A + Hlg-B = Most haemolytic</p> <p>Hlg-C + Hlg-B = Less haemolytic, more leucotoxic</p> <p>Luk-F + Luk-S = Most leucotoxic, not haemolytic</p> <p>The rest are somewhere in-between</p>
Luk-F + Luk-S (PVL)							
Luk-F + Hlg-A							
Luk-F + Hlg-C							
Hlg-B + Luk-S							
Hlg-B + Hlg-A							
Hlg-B + Hlg-C (Gamma hemolysin)							

## Clinical Implications

- Kills polymorphs & macrophages
- Causes tissue necrosis – skin, lungs, soft tissue
- 2 % of all isolates.
- % by type of infection:
  - Furunculosis: 93%
  - Cellulitis: 55%
  - Cutaneous Abscess: 50%
  - Osteomyelitis: 23%
  - Finger-pulp infection: 13%



Clin Infect Dis. 1999; 29: 1128-32

## Clinical Implications

- Can rapidly cause fulminant infection
- Severe necrotic haemorrhagic pneumonia
  - Usually community acquired
  - Usually young & fit
  - Mortality >75%
  - It is the toxin that does the damage

## Clinical Implications

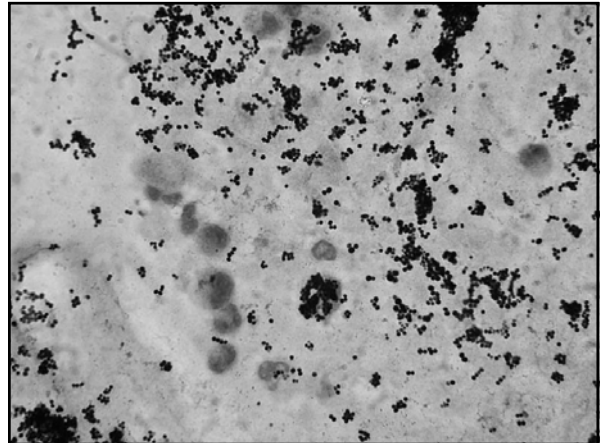
- Lancet 2002; **359**: 753 59:
  - 8 cases of CAP due to PVL+ve *Staph aureus*
  - 6 fatal
  - Young healthy children & adults
- J Clin Micro 2001; **39(2)**: 728 9
  - Infant, breastfed
  - Mum had furunculosis
  - Baby -> periorbital cellulitis -> pneumonia
  - Survived after partial lung resection

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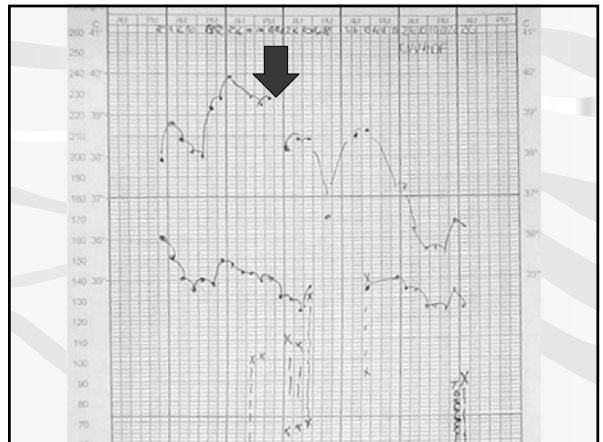
## Pneumonia - Case Study

- 30 yr old woman
- Fit & Well
- Flu like symptoms
- Rapid onset pyrexia, hypoxia, shock, haemoptysis, tachycardia, dyspnoea
- High CRP, low WCC



## Pneumonia - Case Study

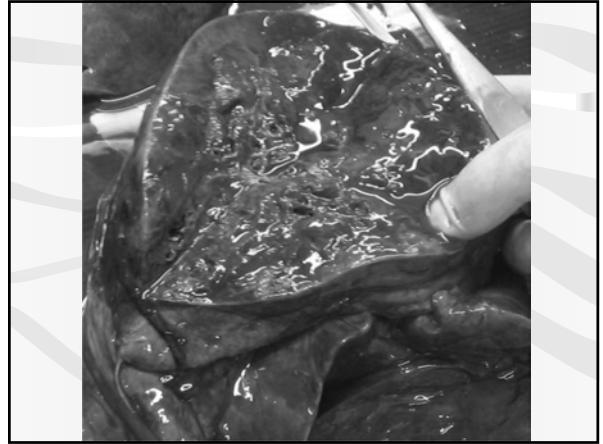
- Sputum grew *Staph aureus*
  - So did blood cultures
- So...
- Heroic antibiotics & pan-European input!
  - Immunoglobulin 2g/kg
  - Intensive Care



**PVL Producing *Staphylococcus aureus***  
**Brenda Dale & Adam Brown**  
**A Webber Training Teleclass**

### Pneumonia – Case Study

- Apyrexial
- Culture negative (sputum, blood) at 24hrs
- Stabilised for several days
- Deteriorated, harder to ventilate
- RIP



### PVL in SW England

- Marine Camp:
  - Sensitive strain
  - Lots of soft tissue infection (often trauma related)
  - One fatality

### PVL in SW England

- The ‘Plymouth Strain’
- Multiresistant (NOT MRSA!):
  - Methicillin sensitive
  - No evidence of *Mec*
  - Always resistant to gentamicin
  - Majority resistant to trimethoprim
  - Usually resistant to macrolides
  - Many resistant to quinolones and fusidic acid
  - Some resistant to tetracyclines

### PVL in SW England

- Plymouth (April 1997 – Nov 2004):
- 315 patients (some with many samples)
- 2d – 99yrs
  - 134 from GPs
  - 16 from Surgical Assessment Unit
  - 21 from A&E
  - 18 from CCDC
  - Remaining from surgical wards

### PVL in SW England

- Boils & abscesses
- 10 sputum +ve
- 5 cystic fibrosis – well
- 4 pneumonia (3 fatal, all elderly)
- Outbreak of mastitis in Derriford Hospital (the only nosocomial cases)

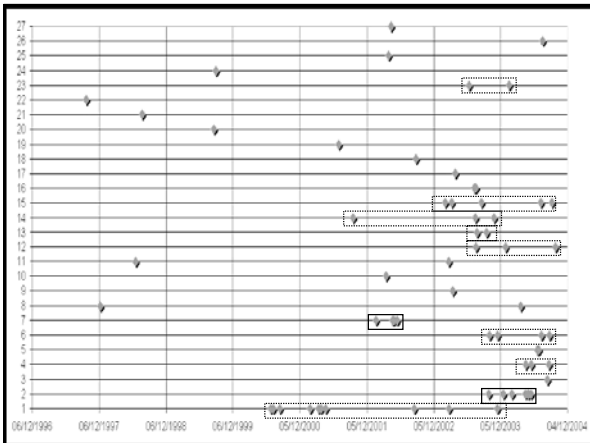
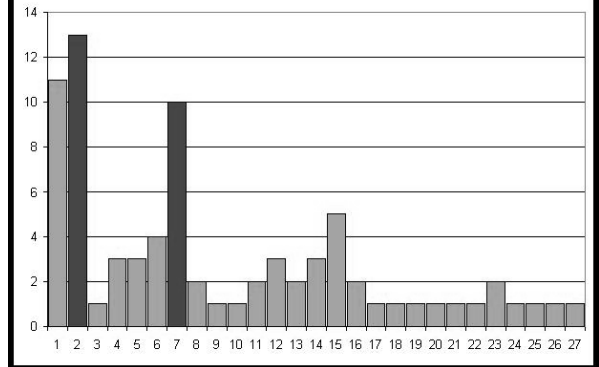
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## PVL in SW England

- Likes nursing homes.
- 27 different nursing homes!
- 1<sup>st</sup> NH isolate in Sept 1997.
- 10 Nursing homes with 2+ cases.
- 2 of these notified as outbreak.



## PVL Staphylococcus Aureus

South West Peninsula Health Protection Unit  
Devon Team



Brenda Dale

2007

### Outbreaks in care homes in Plymouth



- 4 Outbreaks (1 home treated twice)**
- Review of state of hygiene and infection control measures**
- Mass decolonisation treatment**
- Screening for carriage**
- Liaison with Microbiologists, PCT, GPs**
- National guidance**

### Outbreak 1



- Care Home 1 2003/2004**
- Mass treatment**
- All swabbed**
- Decolonised**
- Positives from initial screening re-swabbed**
- Swabs done by NH staff**

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## Outbreak 2



Residential home September 2005  
1 death from PVL Pneumonia  
Enquiries revealed cases with boils  
Swabbed by HPU nurse 90 +  
Mass decolonisation treatment  
Those still colonised at first screen retreated  
Problems - some EMI clients non compliant with treatment  
No further cases to date

## Outbreak 3



January 2006  
Care home 1 – further cases  
1 staff member and 2 clients confirmed PVL decolonised and treated  
Re-swabbed by NH staff and MSSA identified no further PVL

## Outbreak 4



Nursing/Residential Home  
2 year history of boils/abscesses in staff and clients  
Recognised by DN  
?Index case linked with Derriford Hospital mastitis outbreak 03  
Mass decolonisation then screening – in progress results awaited

## Isolated cases in care homes



Information regarding organism  
Transmission  
Cleaning  
Linen  
Equipment

## Families



At least four families affected  
Treatment  
Surgical and drug therapy  
Information for families  
Support



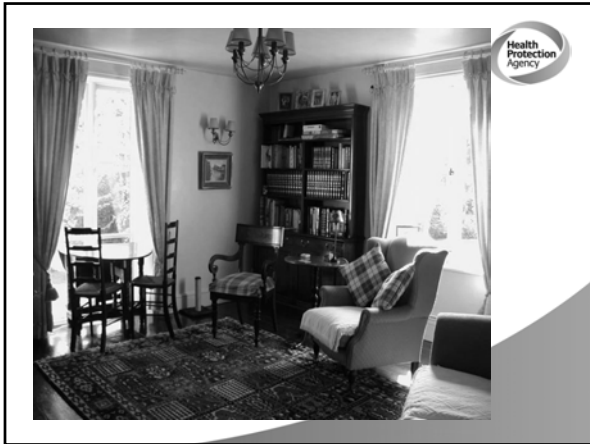
## Issues with care homes



Poor standard of infection control measures  
Environmental hygiene is generally poor  
Not recognising outbreaks  
Lack of compliance with PPE

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### Issues for HPU

Health Protection Agency logo

Increasing problem in the region  
Particularly Devon? Or better recognised ('Plymouth strain')?  
GP newsletter/ care homes  
Recent national guidance – welcome, but needs development  
Regional Microbiology Forum -> working group  
Burden on resources  
lab staff, microbiologist  
HPU  
Care home

### What's this got to do with MRSA?

- PVL +ve MRSA strains exist.
- Community strain(s)
- Not related to hospital strains.
- On the increase –
  - USA
  - Canada
  - France
  - Germany
  - United Kingdom

### PVL +ve MRSA

- *CID* 2005; **40**: 100–7
  - 4 patients
  - 20–52 yrs
  - 25% mortality
- *N Engl J Med* 2005; **352**:1445–53
  - Los Angeles 2003–4
  - 14 cases of nec. Community-acquired pneumonia
  - 28–68 yrs, 71% male, 43% current or past IVDU
  - No deaths!

### PVL +ve MRSA

- France 2000<sup>1,2</sup> – >14 cases
  - Also Germany, Norway
- Alaska 2000<sup>3</sup> – 34 cases linked to sauna
  - Soft tissue infections

1. *Clin Infect Dis* 2002;35:819–24  
2. *Euro Surveill* 2004;9(1):16–8  
3. *J Infect Dis* 2004;189:1565–73

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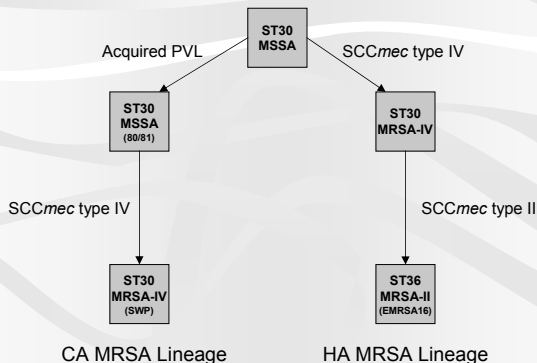
## PVL +ve MRSA

- Steam Rooms of California
- San Francisco jail outbreaks (2001)
- University athletes of LA

## PVL +ve MRSA

- CA MRSA – not the same pedigree as HA MRSA
- ?Descended from 80/81 strain
- Scourge of 50's – 60's
- Eliminated by use of methicillin & flucloxacillin
- Subsequently found to be PVL+ve

### Probable evolutionary model



## Are we all Doomed?

- Undoubtedly a successful strain
- Ecology of MRSA is always changing
- Be aware
- Watch this space – pandemic influenza

(I am a pessimist by the way)

## Further Reading

UK – Department of Health Interim Guidelines:

[http://www.dh.gov.uk/en/Aboutus/MinistersandDepartmentLeaders/ChiefMedicalOfficer/Features/DH\\_413376](http://www.dh.gov.uk/en/Aboutus/MinistersandDepartmentLeaders/ChiefMedicalOfficer/Features/DH_413376)

Canada – Guidelines for management of Community-acquired MRSA:

<http://www.cma.ca/cgi/content/full/176/1/54>

adam.brown@dbh.nhs.uk

THE 37th ANNUAL INFECTION  
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**Keynote speaker: Elaine Larson**  
Professor of Pharmaceutical and Therapeutic Nursing  
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