6-8 November

EICC, Edinburgh

Registration now open

Abstract submission deadline: June 24th

An outbreak of prosthetic valve endocarditis

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Case history

- 82 yr male
- Admitted 7/2/09 to EAU
- PMH Tissue MVR Dec 08 (discharged 16/1/09)
- Chest pain ? ACS ? Musculoskeletal
- Small troponin rise (0.07-0.35)
- ECG unchanged
- ECHO small pericardial effusion (settled)
- CRP 21, no blood cultures done
- Discharged 16/2/09
- DNA’d cardiac surgery follow-up clinic 23/2/09 (further appointment offered)

Case history

- 12/3/09
- Readmitted via ED to HCOP
- Now 12 weeks post MVR
- Breathless & cough
- Systolic murmur
- Troponin 0.11
- Diagnosed as heart failure
- Symptoms settled with diuretics
- CRP 25. No blood cultures
- Rotavirus outbreak – prolonged stay
- Cardiology review (SpR). For re-ECHO as outpatient
- Discharged 25/3/09 with ECHO booked for 3/4/09

Case history

- 30/3/09
- Seen in cardiac surgery follow up clinic
- No record of recent in-patient stays or pending ECHO
- Still breathless but no clinical evidence of failure. No murmur. CXR and ECG satisfactory. Discharge to GP

- 3/4/09
- Outpatient ECHO. Valve dehiscence and mitral regurgitation

Case history

- 26/4/09
- Admitted to DRI
- Worsening breathlessness. Chest infection. Sepsis. Recent ECHO but report not available.
- New ECHO – valve dehiscence, severe MR, endocarditis
- Developed MOF
- 5/5/09 DRI contacted Trent cardiac centre to discuss emergency re-do operation but by then terminally ill
- 6/5/09 RIP. Death certificate - Endocarditis

Prosthetic valve endocarditis

- PVE within 12 months of surgery
  - Often due to organisms acquired around the time of surgery eg coagulase negative staphylococci, diphtheroids
  - Low grade pathogens – but capable of sticking to prosthetic material and forming a biofilm
  - Diagnosis can be difficult
- PVE occuring >12 months
  - Bacteriology resembles that of native valve endocarditis

PVE in Nottingham

- Early onset (within 12 months) PVE quite rare
  - Usually only 1 case per year
- Last issue with PVE cluster was in 1999
- Theatre 4 at City Hospital
- Poor ventilation in theatre (particularly prep room), too many personnel in theatre
- High airborne counts
- Mixture of different strains of CNS
- Moved into new unit in 2006.
- 2 theatres with ultraclean HEPA filtered ventilation. CICU directly adjacent

Case history 2

- 71 yr female
- Tissue AVR and CABG on 14/4/09
- Readmitted to NCH via KMH on 1/7/09 with PVE
- Blood cultures grew *S.epidermidis*.
- Treated with IV vanc, rifampicin
- Emergency re-do on 4/7/09

- ? 1st case of early onset PVE since TCC opened

Detection of outbreak

- 13/7/09
- Monday morning microbiology medic handover meeting
  - VW mentioned possible case of PVE coming in (just been phoned)
  - TB mentioned that was odd as another (case 2) had recently been diagnosed (and had been re-operated on)
  - FD thought there had been another one recently
- Look back on blood culture database and WinPath revealed 2 more recent cases – 1 at QMC and 1 at KMH
- WinPath review
  - All 4 had a *S.epidermidis* with identical (and somewhat unusual antibiogram)
  - All had been operated on by the same consultant
- Surgeon contacted. Immediately agreed to suspend all valve surgery (but continue CABGs).
- Outbreak meeting convened 14/7/09. Vancomycin prophylaxis introduced for all valve surgery

S.epidermidis

- Resistant to:
  - Flucloxacillin, erythromycin, gentamicin, ciprofloxacin, mupirocin (high level), fusidic acid
- Variable to:
  - Trimethoprim, teicoplanin, tetracycline, clindamycin
- Sensitive to:
  - Vancomycin, rifampicin, linezolid

Case finding: look back

- Search of blood culture database
- Search of WinPath for all CNS with same antibiogram. List of patients cross-referenced with cardiac surgery database
- Line listing of all valve surgery patients since 2007 – Winpath review of all of these since Dec 08 and all of individual consultant since Nov 07
- 1 further case found and 1 case of deep infection but not PVE (also the same consultant)
- DRI contacted regarding Case 1
  - Blood cultures has also grown *S.epidermidis* with the same characteristic antibiogram

Case finding – patient recall

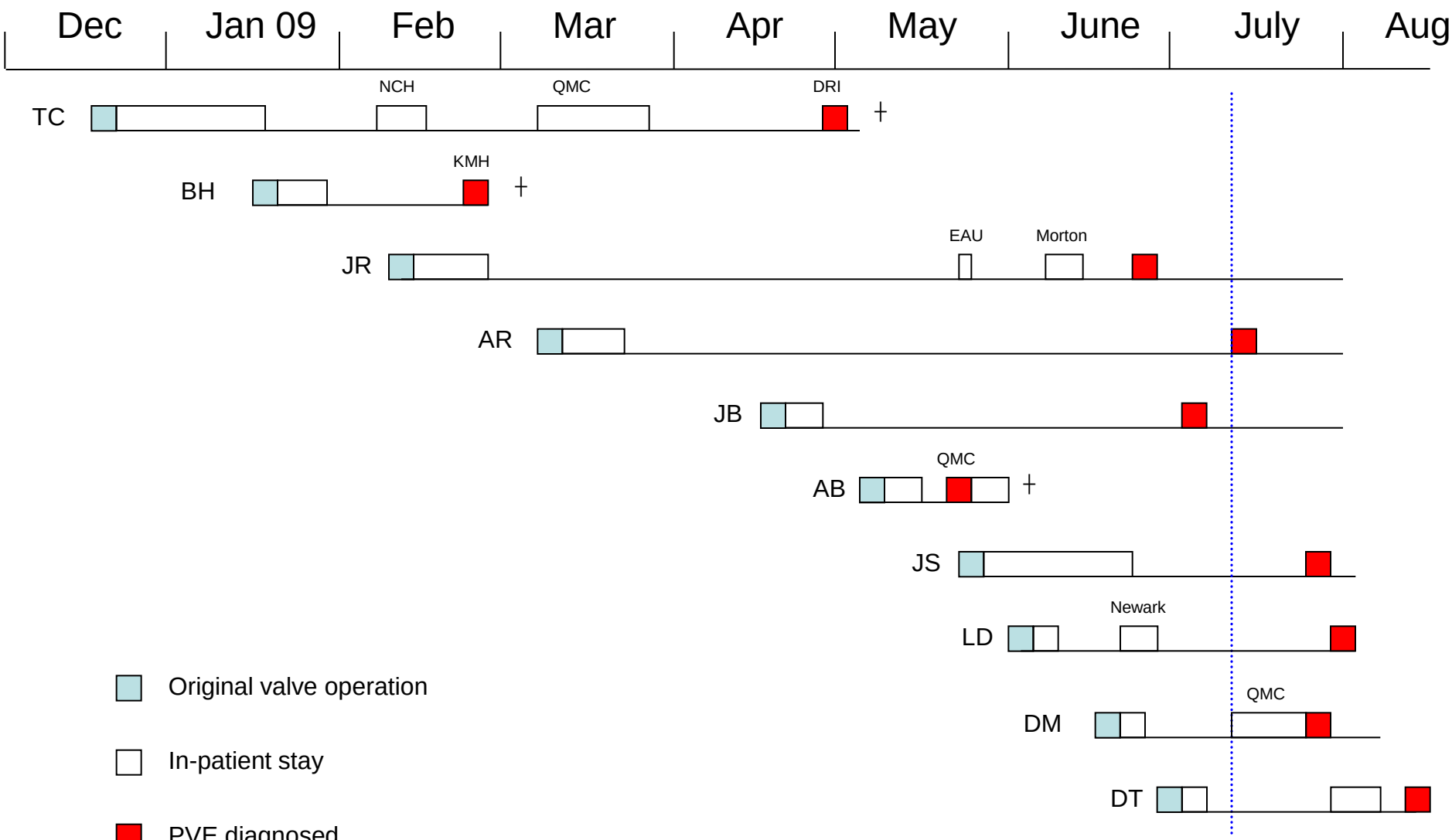
- Commenced 15/7/09
- List of patients deemed to be at risk since Dec 08 (n=15)
- Patients recalled to clinic – blood cultures, ECHO. Admitted if unwell
- To be kept under surveillance for 12 months
- 2 other patients co-incidentally already back in

- 5 of these subsequently became cases
- All grew *S.epidermidis* with same antibiogram

Age at Surg		theatre		STATUS	Micro notes	Date of Operation	Operation	Valve used
82	M	9	Lu J	CASE RIP	Admitted 12/3 with SOB and chest pain. NO BCs done. RIP 6/5/09 Death certificate endocarditis. BCs at DRI x2 grew S.epi 29 & 30 April	16-Dec-08	MVR	31mm St Jude Epic tissue
67	M	9	Lu J	RIP	RIP 25/1/09 at home PM IHD	17-Dec-08	AVR	21mm St Jude Epic Supra tissue
61	F	10	Lu J	RIP	Had 1 x +ve BC in post op period but 2 ANTIBIOTIC DIFFS, RIF, CLIND R RIP 13/11/09 BID to QMC. Coroner's post mortem - no evidence of infection	18-Dec-08	Type A dissection repair	Medtronic freestyle root tissue + Haemashield graft
63	M	10	Lu J			20-Dec-08	MVR + CABGx1 (LIMA to LAD)	29mm St Jude Epic tissue
64	M	9	Lu J			07-Jan-09	AVR	21mm St Jude Epic Supra tissue
82	M	9	Lu J	CASE RIP	Presented to KMH. RIP	21-Jan-09	AVR	21mm St Jude Epic Supra tissue
60	F	9	Lu J			27-Jan-09	AVR	21mm St Jude Epic Supra tissue
71	M	9	Lu J	CASE	Re-do valve op. Further leak. Redo redo on 19/11/09	10-Feb-09	AVR	23mm St Jude Epic Supra tissue
76	M	9	Lu J			24-Feb-09	AVR	21mm St Jude Epic Supra tissue
51	M	9	Lu J		Had coag -ve staph IE as reason for op and was on vanc and gent post op for several weeks	03-Mar-09	MVR	35mm St Jude Master mechanical
72	M	9	Lu J	CASE (but not PVE) RIP	Not PVE, but sternal infection and blood culture / pleural fluid +ve. After reversal of ?colostomy, developed ishaemic bowel and died.	10-Mar-09	CABGx3 (LIMA to LAD, SVG to distal Cx and distal RCA)	30mm Sequin annuloplasty ring
62	M	9	Lu J	CASE RIP	Currently on CICU. Had energency redo and vanc and linezolid. Re-do also became infected. 2nd red0. RIP shortly after surgery. Coroner.	11-Mar-09	AVR	21mm Sorin slimline mechanical
72	M	9	Lu J		Readmitted 20/11 for assessment and bloods Had TIA in October. CT/MRI. No BCs done at time. BCs done in Nov all -ve.	17-Mar-09	AVR	21mm St Jude Epic Supra tissue
67	M	9	Lu J			24-Mar-09	AVR	23mm St Jude Epic Supra tissue
67	F	9	Lu J	CASE	Admitted to B3 QMC on 5/7 with ? CVA but self-discharged on 6/7 Readmitted 17/11. Multiple BCs +ve and ECHO showed MV leak and veg	31-Mar-09	MVR	27mm St Jude Epic tissue
71	F	9	Lu J	CASE	Re-do valve op	14-Apr-09	AVR + CABGx1 (LIMA to LAD)	21mm St Jude Epic Supra tissue
82	M	9	Lu J	CASE RIP	RIP whilst awating redo	23-Apr-09	AVR	21mm St Jude Epic Supra tissue
73	M	9	Lu J			05-May-09	AVR	25mm St Jude Epic Supra tissue
63	F	9	Lu J		Some SOB. ? Some MR and AF. ECHO booked 25/11	19-May-09	AVR	19mm St Jude Epic Supra tissue
70	M	9	Lu J	CASE	1xBC +ve 29/5/09. Now has aortic valve abscess with paravalvular leak. Rpt BC +ve and valve. Emergency redo. On vanc and rif. New valve now has severe leak + aortic root aneurysm. Redo redo surgery on 23/11/09	20-May-09	AVR	23mm St Jude Epic Supra tissue
77	F	9	Lu J	CASE	Presented to Newark Hosp post-op. Blood cultures x 4 for ? Endocarditis but -ve. Now paravalvular leak and root abscess. BCs +ve x3. Emergency redo. Now on vanc and rif	27-May-09	AVR	19mm St Jude Epic Supra tissue
73	M	9	Lu J			02-Jun-09	MVR	33mm St Jude Epic tissue
72	M	9	Lu J	RIP	RIP 13/6/09 (3 days after discharge) PM IHD	03-Jun-09	AVR	21mm St Jude Epic Supra tissue
81	M	9	Lu J	CASE RIP	Readmitted to QMC with arrythmia. Developed severe AR. Emergency redo. Rx vanc and rif. Poor outlook, confused, refusing antibiotics. Subsequently RIP	10-Jun-09	AVR	23mm St Jude Epic Supra tissue
67	F	9	Lu J	POSSIBLE CASE	Had 2/52 of vanc and for 4/52 of linezolid as precaution for 1 x +ve blood culture.	16-Jun-09	AVR + MVR + closure PFO	19mm St Jude Epic Supra tissue + 29mm St Jude Epic tissue
64	M	9	Lu J	CASE	Fevers. Murmur. ECHO NAD, but being admitted as precaution. Sent home then readmitted 11/8 more fevers, campylobacter diarrhoea, BC +ve x4 bottle	23-Jun-09	AVR	25mm St Jude Epic Supra tissue
78	F	9	Lu J		Readmitted 16/7/09 on EAU. BCs done etc and reviewed by DR. Went home. Subsequently diagnosed with ? Cerebral tumour	30-Jun-09	AVR + CABGx1 (LIMA to LAD)	19mm St Jude Epic Supra tissue
79	M	9	Lu J	POSSIBLE CASE	for 4/52 of linezolid as precaution for 1 x +ve blood culture	07-Jul-09	AVR + CABGx1 (SVG to PDRCA)	21mm St Jude Epic Supra tissue

Summary

- 28 valve operations since Dec 08
- 11 cases of PVE
  - 5 deaths
  - 6 emergency valve replacement
  - 1 managed with antibiotics alone
  - 1 patient with deep sternal infection
- 3 patients with single +ve blood culture
  - 2 treated pre-emptively with 6 weeks of antibiotics
- 2 deaths due to IHD, 1 death due to sudden arrhythmia



Timeline showing dates of operations and diagnoses of the 10 cases of *S.epidermidis* PVE

Further investigations

- Checked theatre ventilation
- Environmental sampling on CICU (42 samples)
  - Outbreak strain not recovered
  - Theatres ands CICU then thoroughly cleaned
- Screening of staff for hand carriage
  - Hand rinse
  - Stomacher bag with 100 ml of BHI broth
  - Each hand rinsed and agitated for 30 sec
  - Incubated overnight
  - Subcultured onto agar with mupirocin, gentamicin and ciprofloxacin
- Typing of all available *S.epidermidis* strains
  - PFGE at LHI
  - Some epidemiologically unrelated strains with same antibiogram also being sent

Results

- Typing of patients strains
  - All same PFGE except 1 patient
  - Same PFGE type recovered from hand rinse cultures of surgeon
- Hand carriage
  - Same antibiogram found in:
    - 9/10 CICU nurses
    - 6/14 theatre staff
    - 3/5 consultant surgeons
  - But PFGE typing showed different variants

Table 1. Summary of cases of *S.epidermidis* infections in cardiac surgery

Patient	Date of Operation	Operation Valve used	Infection (month/year diagnosed)	Organism	DNA typing	Outcome	Re-do surgery
Case 1	16/12/08	MVR St Jude Epic tissue	PVE (May 2009)	*S.epidermidis*	PFGE type a4	Died (06/05/09)	No
Case 2	21/01/09	AVR St Jude Epic Supra tissue	PVE (Feb 2009)	*S.epidermidis*	Not available	Died (23/02/09)	No
Case 3	10/02/09	AVR St Jude Epic Supra tissue	PVE (Jun 2009)	*S.epidermidis*	PFGE type a	Alive	Yes x 2
Case 4	10/03/09	MV repair, CABG Seguin annuloplasty ring	Deep sternal (Mar 2009)	*S.epidermidis*	Not available	Died (29/08/09)[1]	No
Case 5	11/03/09	AVR Sorin slimline mechanical	PVE (July 2009)	*S.epidermidis*	PFGE type a	Died (06/10/09)[2]	Yes x 2
Case 6	31/03/09	MVR	PVE (Nov 2009)	*S.epidermidis*	PFGE type a	Alive	Yes
Case 7	14/04/09	AVR + CABG x1 St Jude Epic Supra tissue	PVE (Jun 2009)	*S.epidermidis*	PFGE type a	Alive, residual VSD	Yes
Case 8	29/04/09	AVR St Jude Epic Supra tissue	PVE (May 2009)	*S.epidermidis*	PFGE type a	Died (30/05/09)	No[3]
Case 9	20/05/09	AVR St Jude Epic Supra tissue	PVE (July 2009)	*S.epidermidis*	PFGE type a	Alive	Yes x 2
Case 10	27/05/09	AVR St Jude Epic Supra tissue	PVE (July 2009)	*S.epidermidis*	PFGE type a	Alive	Yes
Case 11	10/06/09	AVR St Jude Epic Supra tissue	PVE (July 2009)	*S.epidermidis*	PFGE type a	Died (Nov 09)	Yes[4]
Case 12	16/06/09	MVR/AVR + closure PFO St Jude Epic tissue/St Jude Epic Supra tissue	Post-op bacteraemia (Jun 2009)	*S.epidermidis*	Not available	Alive	No
Case 13	23/06/09	AVR St Jude Epic Supra tissue	PVE (Aug 2009)	*S.epidermidis*	PFGE type a	Alive, has VSD	No
Case 14	07/07/09	AVR + CABG x1 St Jude Epic Supra tissue	Post-op bacteraemia (July 2009)	*S.epidermidis*	PFGE type a	Alive	No

PFGE – pulsed field gel electrophoresis

1. Died of un-related cause (ischaemic bowel post reversal of ileostomy)
2. Died shortly after 2nd re-do AVR following recurrent *S.epidermidis* infection after 1st re-do AVR
3. Died shortly before planned re-do surgery
4. Further paravalvular leak plugged with percutaneously deployed device.

Hand rinse cultures

Area	Number sampled	Multi-resistant ? S.epidermidis Res: flu, gent, mup, cip	PFGE Typing	Comments
CICU Nurses	10	9	a1, a4, a5, a6, a8, 2 x distinct	1 mixed culture, 1, S.haemolyticus
Theatre Staff	9	5	a4, a7	3 mixed culture
Consultants	5	3	a, a4, distinct	

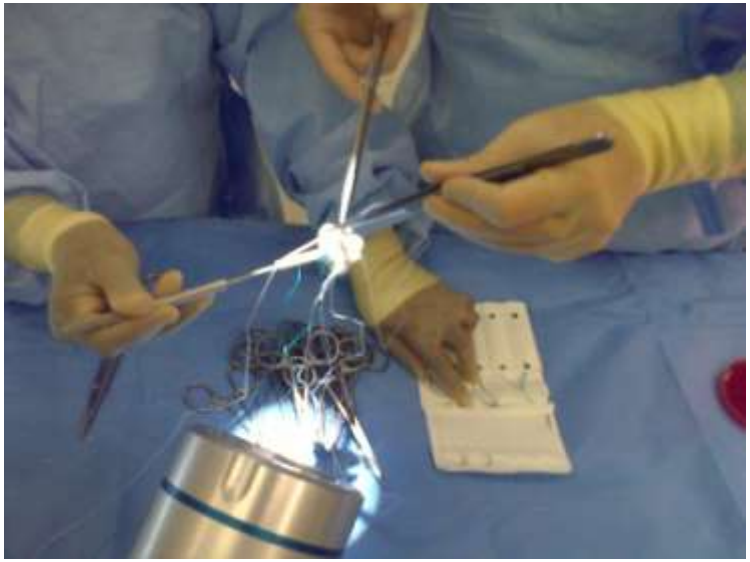
Outbreak summary

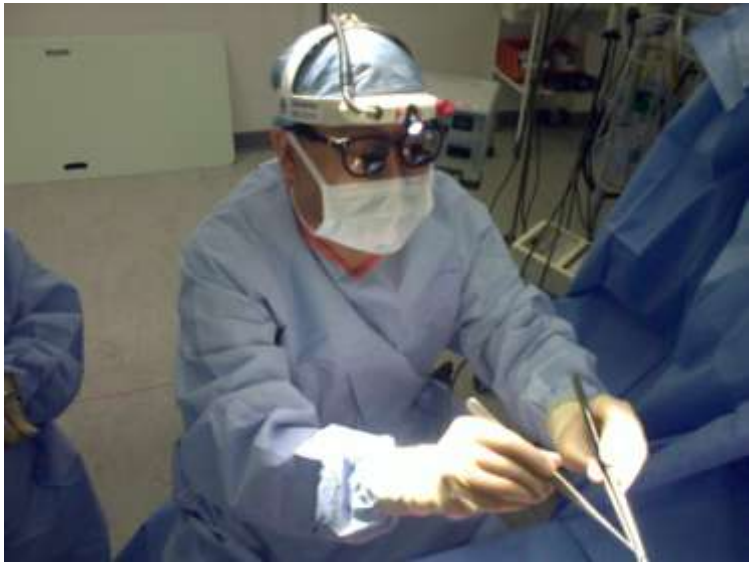
- 11 cases of PVE - all operated on by one surgeon
- No cases in other surgeons
  - 11/28 versus 0/105 ($p<0.0000001$)
- No other member of staff present at all 11 operations
- All caused by *S.epidermidis*. All but one were due to DNA fingerprint type “a”
- Surgeon was found to be carrying “a” on hands and elsewhere
- Strain “a” was not found on the hands of 23 other staff (surgeons, CICU nurses, theatre personnel)
- Infections were acquired in theatre

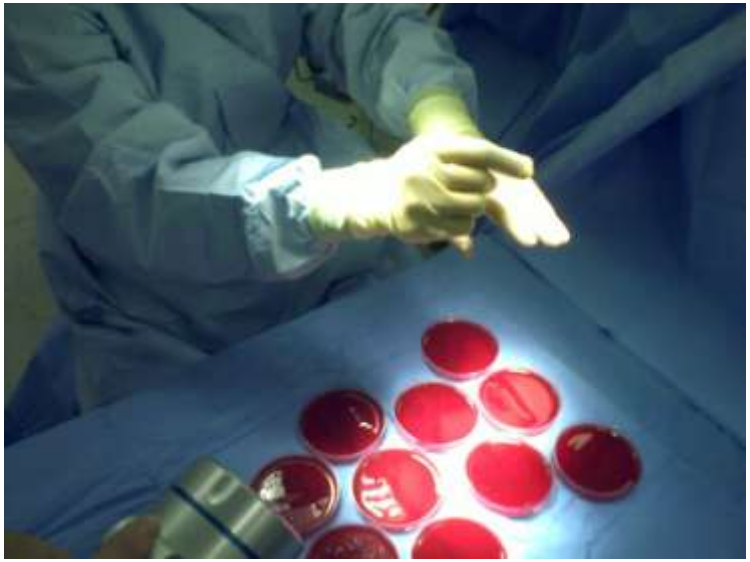
- This strain of *S.epidermidis* was resistant to the surgical antibiotic prophylaxis
- Route of transmission from surgeon not clear
  - Airborne
  - Micro-puncture of gloves
  - Contamination of gloves during glove changing

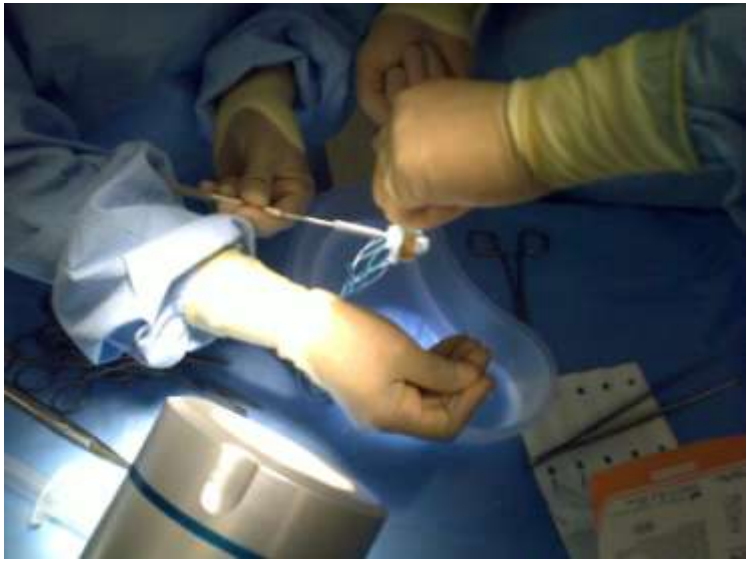
Further investigations

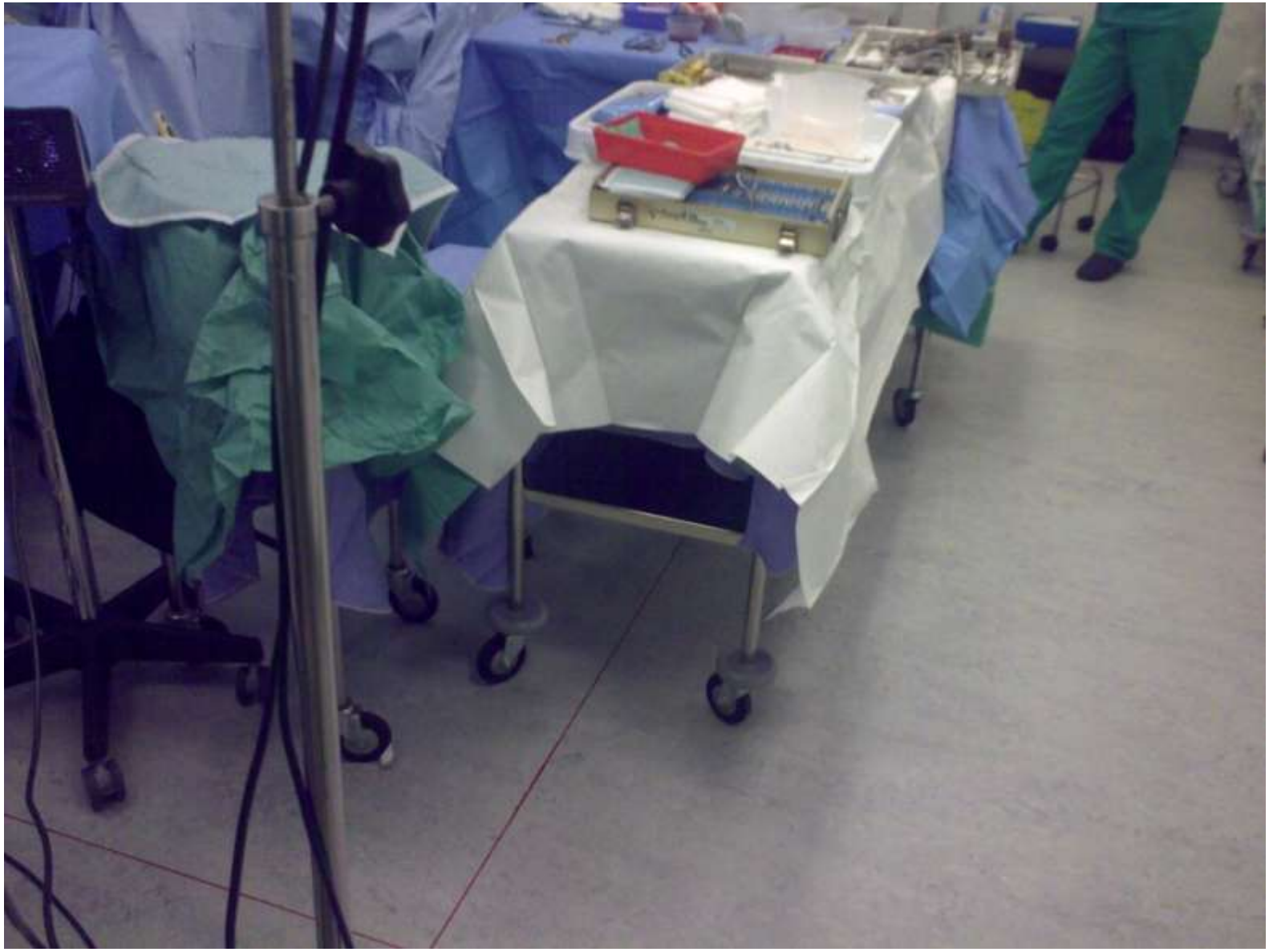
- Observation of operations
- Theatre settle plates
- Sterility of gloves at end of procedure
- Technique for scrubbing up and donning gloves and gowns
- Technique for changing gloves
- Type of gloves worn
- Any other procedural differences between different consultants











Intra-operative blood cultures

24/8/09 to 4/9/09

Blood cultures done at start, in middle and at end of operation 6, bottles, 3 sets)

Cons	Number of patients (sets)	Positive sets	
JCL	6 (18)	1	S.warneri PFGE type c from Set 2 Resistant to: fluclox, gent, rif, trim, ery. Sens to: mup, cip, fuc
DR	5 (15)	1	Propionibacterium from Set 1
SKN	7 (21)	1	Micrococcus from Set 1
IMM	4 (12)	0	
RSJ	2 (6)	0	
TOTAL	24 (72)		

Consultant hand study

Date/time	Sample	Lab Number	TVC (BA 18 hrs)	Resistant S.epidermidis	Broth appearance (18 hrs)	Broth Sub BA	Broth Sub selective	Resistant S.epidermidis
09-Sep-09	Sterile glove rinse after changing gloves	09W348372			Clear (48hrs)			NOT isolated
09-Sep-09	Sterile glove rinse after changing gloves	09W348371			Clear (48hrs)			NOT isolated
08-Sep-09	Sterile glove rinse after changing gloves	09W348374			Clear (48hrs)	No growth		NOT isolated
08-Sep-09	Sterile glove rinse after changing gloves	09W348373			Clear (48hrs)	No growth		NOT isolated
2-Sep-09 9.30	Hand rinse before scrubbing	09W348128	18 CFU	Isolated PFGE type a	Cloudy	Bacillus + CNS	CNS	Isolated
2-Sep-09 1.00	Sterile glove rinse at end of operation	09W348129	0 CFU	----------	Bloodstained	scanty CNS fully sensitive	No growth	NOT isolated
2-Sep-09 1.05	Hand rinse after removal of gloves	09W348130	4 CFU	Isolated	Clear	No growth	No growth	NOT isolated
2-Sep-09 2.05	Hand rinse before scrubbing	09W348131	10 CFU	Isolated	Cloudy	Bacillus + CNS	CNS	Isolated PFGE type a
2-Sep-09 2.10	Hand rinse after scrubbing	09W348132	0 CFU	----------	Clear	No growth	No growth	NOT isolated
25-Aug-09	Sterile glove rinse at end of operation	09W347922			Bloodstained		No growth	NOT isolated
25-Aug-09	Removed glove L	09W347923			Cloudy		No growth	NOT isolated
25-Aug-09	Removed glove R	09W347924			Cloudy		No growth	NOT isolated

Date/time	Air Sample	Lab Number	TVC (BA 48 hrs)	Resistant S.epidermidis
09/09/2009 Mid operation	1000 litres near sternal wound under ultraclean canopy.	09W348367	1 CFU not CNS	NOT isolated
09/09/2009 Mid operation	1000 litres near instruments just outside ultraclean canopy	09W348368	3 CFU 1 ? CNS	NOT isolated
09/09/2009 End of operation	250 litres over instruments prior to glove change	09W348369	0 CFU	NOT isolated
09/09/2009 End of operation	250 litres over instruments during glove change	09W348370	1 CFU Bacillus sp	NOT isolated
25-Aug-09	Settle Plate 1 under table	09W347927	0 CNS	NOT isolated
25-Aug-09	Settle Plate 2 under instrument trolley	09W347928	0 CNS	NOT isolated
25-Aug-09	Settle Plate 3 On diathermy machine	09W347929	0 CNS	NOT isolated
25-Aug-09	Settle Plate 4 On Floor by JL	09W347930	0 CNS	NOT isolated
25-Aug-09	Settle Plate 5 On floor under light source	09W347931	1 CFU CNS Res: flu, gent, mup, trim, teic	Isolated PFGE type b

Country Year	**Nos. of patients**	**Incubation period**	**Routine antibiotic prophylaxis**	*S.epidermidis* **resistant to:**		**Typing**		**Staff sampling**	**Air sampling**	**Source & Control measures**
				Oxa/ Met	Gent	Methods	Results			
Canada[1,2] 1973-4	9 (all PVE)	11 days – 20 months Median 4 months	Penicillin + streptomycin	Y	N	Plasmid analysis	Some clustering of strains	Nose swabs from 5/6 surgeons	Settle plates in OR – no increase in counts	Not identified Limited nos. of personnel in OR
Holland[3] 1981	5 (4 PVE)	2 days – 2 months	Not stated	Y	? N	Biotyping & phage typing	Single strain Matched surgeon A	Surgeon (nose, forehead, hands)	Not reported	Surgeon A (epidemiology & typing). Postulated glove puncture Stopped performing valve ops
	6 (no clinical infections)	Not applicable		Y	? N		Single strain Matched surgeon B	Surgeon (site not stated)		Surgeon B (epidemiology & typing) No action taken
UK[4] 1981	4 (2 PVE)	Not stated	Fluclоxacillin + gentamicin	Y	Y	Plasmid	Variety of strains	Extensive survey (nose, axilla, hands)	Not performed in OR	Not identified Ward and OR cleaned
USA[5] 1982	4 (all PVE)	6 weeks – 8 months	Not stated	Y (3/4)	Y	Plasmid analysis	Single strain	Surgeon	Not reported	Epidemiology suggested surgeon with chronic hand dermatitis but not proven by typing Control measures not stated
New Zealand[6] 1987-89	3 (all PVE)	7 days – 2 months	Cephradine	Y	Y	Plasmid analysis	Different strains	Not done	Not reported	No common source
USA[7] ?1988	10 (2 PVE)	6 - 15 days (PVE cases)	Not stated	Y	Y	Plasmid analysis	Single strain that matched surgeon	Selected surgical / OR staff	Outbreak strain not isolated	Single surgeon (epidemiology and typing) Postulated glove puncture Temporarily stopped surgery
USA[8] 1998	8 (6 PVE)	7 – 50 days Median 15 days	Cefazolin+/- vancomycin	Y	?	PFGE	4/6 strains were identical	Selected OR staff		Epidemiology suggested single surgeon with chronic hand dermatitis but not proven by typing Glove changing technique changed, OR aseptic procedures re-inforced. Vancomycin prophylaxis introduced
Spain[9] 2000-2	8 (5 PVE)	Median 110 days	Not stated	Y (7/8)	N	Not done		Not done		Not identified ? lapses in IC procedures in OR

6-8 November

EICC, Edinburgh

Registration now open

Abstract submission deadline: June 24th