Increased Catheter-Associated Bloodstream Infection Rates After the Introduction of a New Positive Pressure Mechanical Valve Intravenous Access Device

Bharti Asnani, M.D.[1], Elias Abrutyn, M.D[1]., Barbara Fry-Arrighy, B.S., CIC[2], Angela Paravicini, M.S.[2], Judith A. O'Donnell, M.D.[1]

[1] Drexel University College of Medicine,

[2] Hahnemann University Hospital, Philadelphia PA

DISCLOSURE STATEMENT

NOTHING TO DISCLOSE

BACKGROUND

- Central venous catheters (CVCs) are commonly used and are a potential source of bloodstream infections (BSIs)
- Several different types of ports, or intravenous access devices, are used to access the lumen of the CVC
- Both CVC and intravenous access device design have evolved over time
  - Closed ports (decreased contamination rate)
  - Needleless devices (decreased sharps injuries)
  - Positive pressure ports (decreased catheter clotting)

BACKGROUND

- Three different closed port, needleless connector designs exist:
  - Split septum connector
  - Luer activated valve
  - Luer valves with positive displacement

Positive Pressure Mechanical Valve (PPMV) Ports

- Developed to maintain catheter patency without the use of heparin flushes
- Reduces clotting of the catheter
- Recent concerns have been raised about increased CA-BSI rates with the use of some mechanical valve ports, and specifically with use of PPMV ports[1]
- Mechanical valve ports and PPMV ports have internal surfaces where microorganisms may attach, and thus difficult to eradicate

[1] Lisa L. Maragakis, MD; Karen L. Bradley, RN et al. Increased Catheter-Related Bloodstream Infection Rates After the Introduction of a New Mechanical Valve Intravenous Access Port. infection control and hospital epidemiology January 2006, vol. 27, no. 1

OBJECTIVE

- To evaluate the rate of CA-BSI before and after the introduction of a PPMV intravenous access port device in our institution.

THE INSTITUTION

- Hahnemann University Hospital (HUH):
  - 450 bed tertiary care, university medical center
  - Several types of Intensive Care units (ICUs)
    - Medical
    - Cardiology
    - Surgical/Trauma
    - Cardiothoracic
    - Neurology
    - Progressive Care Unit (ventilator step-down unit)

METHODS

- Study design: Observational
- Study Period: January 2005 through August 2006
- The HUH Infection Control Department performs monthly active hospital-wide surveillance for CA-BSI
- CDC criteria and National Nosocomial Infection Surveillance definitions are used
- Before July 2005, our institution used a needleless mechanical valve port (Smartsite Needle Free valve, Alaris Medical Systems)

METHODS

- In July 2005 a PPMV intravenous access port (SmartSite Plus Needle-Free Valve, Alaris Medical Systems) was introduced
- Education on proper use of the PPMV port was provided to all pertinent healthcare workers prior to introduction of the new product
- Additional education was provided in October-December 2005

METHODS

- Most hospital policies were unchanged during the study period regarding CVCs including:
  - Placement
  - Use
  - Care
  - Access

METHODS

- April 2006: hospital policy regarding who could place CVCs was restricted:
  - Departments of Surgery and Anesthesiology physicians not affected by this policy
  - Department of Medicine: only physicians with advanced training and certification
- July 2006: a policy was implemented in all ICUs to discard all intermittent IV tubing after 24 hours

METHODS: DEFINITIONS

- Inclusions:
  - NNIS Definitions for CA-BSI:
    - any inpatient with CVC placed during current hospitalization who develops positive blood cultures more than 48 hours after admission
    - a recognized pathogen is cultured from one or more blood cultures and is not related to an infection at another site

METHODS: DEFINITIONS

- Exclusions:
  - CVC placed pre-hospitalization
  - Secondary bacteremia's
  - Blood culture grows a common skin contaminant (eg. diphtheroids, Bacillus sp., Propionibacterium sp., coagulase-negative staphylococci, or micrococci)

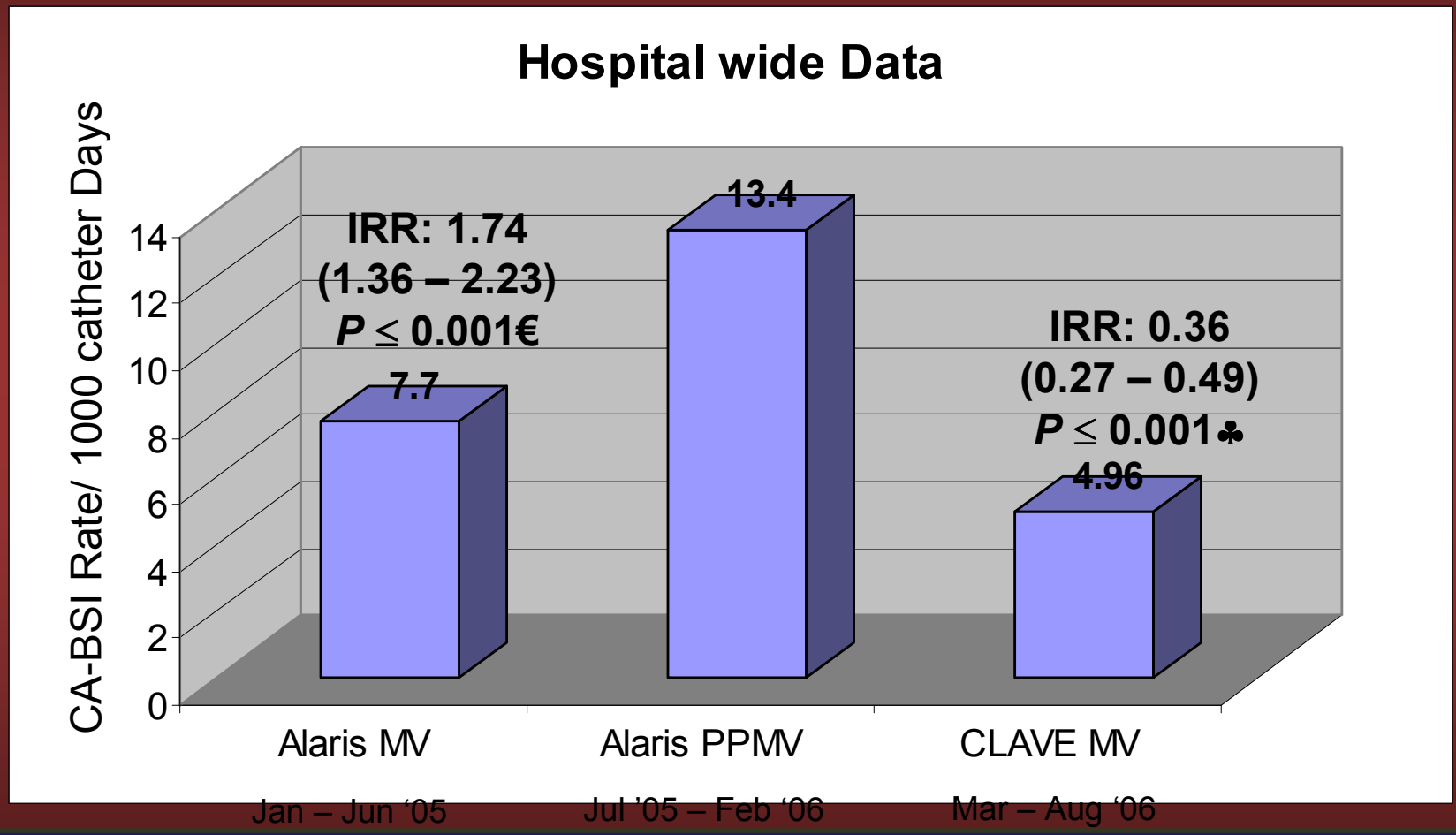
STATISTICAL ANALYSIS

- Incidence rate ratios (IRR) were calculated to compare the rate of CA-BSI before, during and after use of the PPMV port
- 95% confidence intervals (CIs) and *P* values were calculated

RESULTS

- Observed rates of CA-BSI consistently increased after implementation of the PPMV port hospital-wide
- No other reason for this increase could be ascertained
- Use of the PPMV device was discontinued in February 2006, and a new MV CVC port was introduced (CLAVE needle free connector, ICU Medical)

RESULTS: Hospital Wide



€ Comparison of Pre-PPMV with PPMV use

♣ Comparison of PPMV with MV use

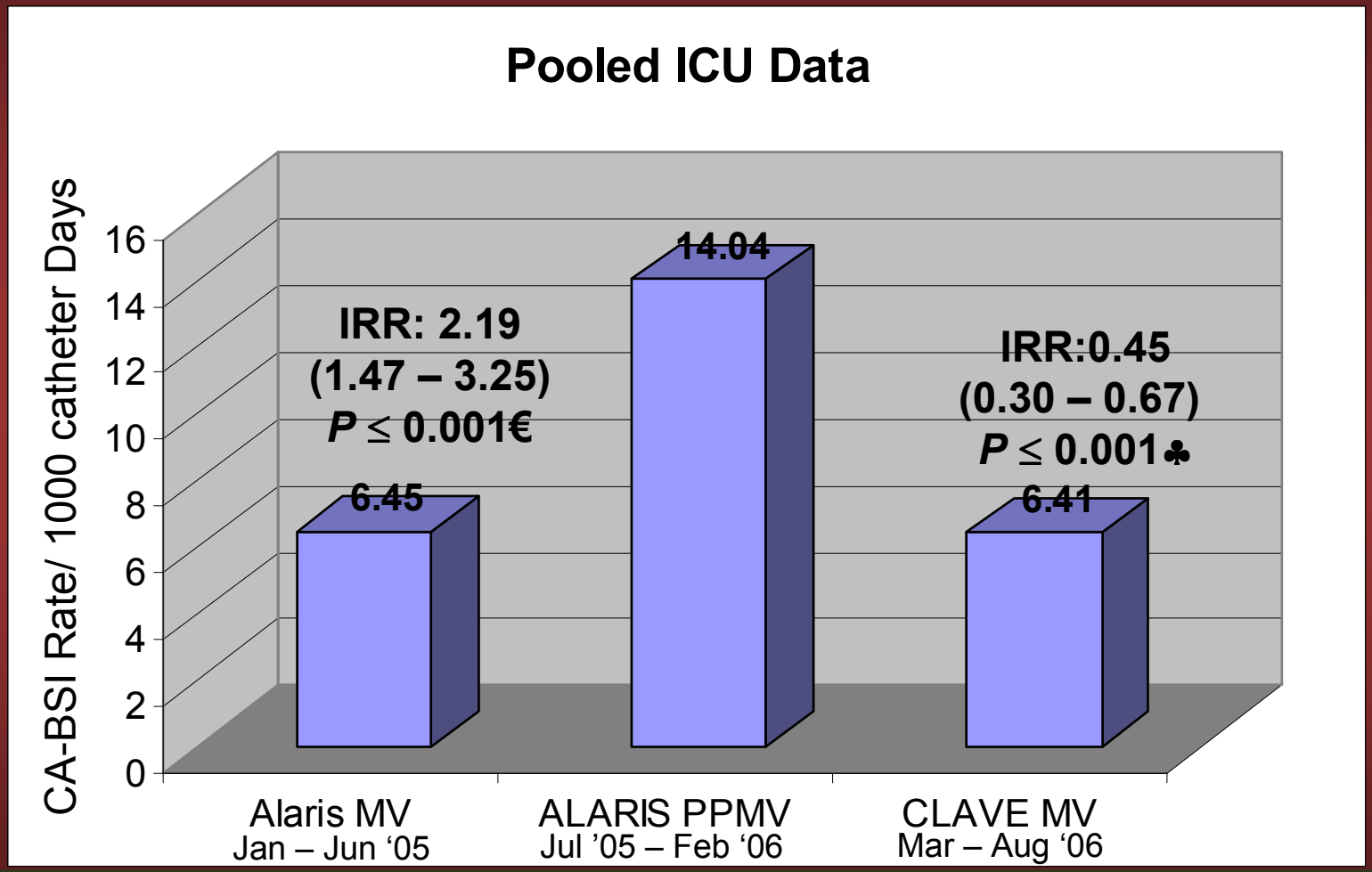
RESULTS : HOSPITAL-WIDE DATA

Time Period	CVC Port In Use	CA-BSI Rate/ 1000 catheter days	IRR (95% CI) *P*-value
Jan '05 – June '05	Alaris MV	7.7	1.74 (1.36 – 2.23) ***P* ≤ 0.001€**
July '05 – Feb '06	Alaris PPMV	13.4	
March '06 – Aug '06	Clave MV	4.96	0.36 (0.27 – 0.49) ***P* ≤ 0.001♣**

€ Comparison of Pre-PPMV with PPMV use

♣ Comparison of PPMV with MV use

RESULTS: ICU



€ Comparison of Pre-PPMV with PPMV use

♣ Comparison of PPMV with MV use

RESULTS: POOLED ICU DATA

Time Period	CVC Port In Use	CA-BSI Rate/ 1000 catheter days	IRR (95% CI) *P*-value
Jan '05 – June '05	Alaris MV	6.45	2.19 (1.47 – 3.25) ***P* ≤ 0.001€**
July '05 – Feb '06	Alaris PPMV	14.04	
March '06 – Aug '06	Clave MV	6.41	0.45 (0.30 – 0.67) ***P* ≤ 0.001♣**

€ Comparison of Pre-PPMV with PPMV use

♣ Comparison of PPMV with MV use

CONCLUSIONS

- We report a significant increase in the CA-BSI rates after the introduction of the new PPMV throughout our hospital, and specifically in the ICUs
- CA-BSI rates decreased below baseline once the PPMV was removed from the institution
- Our experience adds further evidence to support an association between increased CA-BSI rates and the use of PPMV ports