

# Patient Controlled Analgesia: More than twenty-five years in the making: Where are we now?

ASPMN 19<sup>th</sup> National Conference  
Jacksonville, Florida  
September 15<sup>th</sup> 2009

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## Goals and Objectives

- Describe quality improvement models for PCA and the role of nursing and pharmacy in these models
- Discuss pain management in the acute care and ambulatory environment
- Integrate the management of risks associated with PCA use and adequacy of analgesia
- Identify the features of PCA technology that impact nursing workflow and methods for reducing errors



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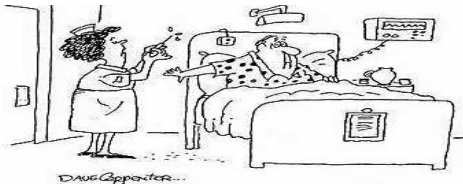
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## History of the PCA



"NOT IN THE ARM, MR. JASON, I'M AFRAID THIS ONE HAS TO BE A MOONSHOT."



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### Evolution of analgesic delivery

- IM to IV
- Medications used for analgesia
- Intermittent IV bolus by nursing
- Development of the delivery device
- First pumps in use



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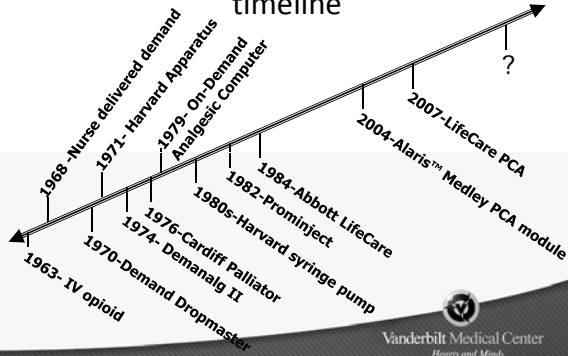
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### Pump technology development timeline



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### PCA - In the beginning...

- Roe 1963- small IV doses of opioids = increased efficacy
- Forrest 1970 – Demand Dropmaster
- Sechzer 1968, 1971 – RN administered doses on patient demand, then by pump
- Keeri Szanto 1974 – Demanalg pump
- “Cardiff Palliator” 1976 1<sup>st</sup> commercially available PCA pump – Welsh National School of Medicine



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## 2<sup>nd</sup> wave of Technology

1984 PCA introduced for hospital setting

- First self contained device allowing the patient to self administer their own pain medication
- Automated settings allowed:
  - PCA dose from 0.1 to 5.0ml in 0.1ml increments
  - Loading dose options from 0.1 to 9.9 ml in 0.1 ml increments
  - Lockout intervals from 5 to 99 minutes in 1 minute increments
- Used commercially available syringes that decreased compounding errors.



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## 1<sup>st</sup> Generation PCA Devices




Harvard PCA




On-demand analgesia computer




Abbott LifeCare



Cardiff Palliator



Prominect



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## 2<sup>nd</sup> Generation PCA Devices



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### 2<sup>nd</sup> wave of Technology

- Integration of bar code technology
  - Built into the pump or integrated with device
  - Ability to read vendor generated or custom barcodes
- Concept of combination therapy
  - Enhanced modes of delivery: Bolus Only and Continuous + bolus
- Increased drug and concentration options
- Transaction logs retained in device
- Chronological record of most recent events
  - Allows review at bedside of previous shifts administration



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### 2<sup>nd</sup> wave of Technology

- Expanded capability to utilize pharmacy filled vials
  - Allowing pharmacy to use custom filled empty sterile vials
    - utilize manufacturer pre-filled vials (~18 months expiration)
  - Pre-filled vials with bar coded & color enhanced labels to aid in the readability of drug and drug concentrations
  - Ability to utilize dispensing cabinets



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### 3<sup>rd</sup> wave of technology

Introduction of Safety Software with wireless/wired connectivity

- Rule Sets / Profiles
  - Hard / Soft dosing limits configurable for each medication
- Safety programming
  - Final Confirmation Screens
  - Ergonomic design for safer use
- Wireless functionality allows ease of data transfer from pumps
  - Infusion data at a glance
  - Alarms/Events
  - Asset tracking functionality
  - Validation of compliance with policy use



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**Shift control from provider to patient**

- Prior to 1960's; injectable pain medications given IM; morphine used for surgical anesthesia during Civil War with advent of the hypodermic needle
- Efficacy of small IV doses of pain medication proven in 1960's
- Delicate balance of patient assessment & adequate analgesia; response to Nurse call; dose administration a challenge



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**Shift control from provider to patient**

Advent of PCA technology allowed transition of control to the patient

- Enhanced Quality of Analgesia
- Benefits of Control
- Barriers to PCA
- Care givers barriers and biases



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**Pain Management with PCA**

Acute Care Setting

- Acute Pain
  - Surgical
  - Non surgical
- Chronic Pain
- Cancer Pain



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**Pain Management with PCA**

Special Populations

- Pediatrics
- Geriatrics
- Oncology



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**Pain Management with PCA**

Ambulatory Care

- Duration of use
- Type of delivery device
  - Disposable vs Non disposable
- Evolving technology
  - Transdermal delivery systems



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**Pain Management with PCA**

Ambulatory Care

- Chronic Analgesia
  - Multimodal therapies



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**Pain Management with PCA**

Pharmacology – long acting opioids

- Morphine
- Hydromorphone
- Meperidine



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**Pain Management with PCA**

Pharmacology – short acting opioids

- Fentanyl
- Remifentanyl
- Sufentanyl



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**Pain Management with PCA**

Pharmacology – non opioids

- Nonsteroidal agents
- Anesthetics
- Other



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**Non-pain uses of PCA**

- Antiemetics
- Supportive therapies



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**Assessment of the PCA patient**

Adequacy of pain management

- Pain scales
- Patient Education
  - Pain reassessment
  - Response to inadequate treatment
    - Escalation of therapy



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**Assessment of the PCA patient**

Side effects

- Respiratory Depression
  - Monitoring
  - Treatment
- Nausea/vomiting
  - Monitoring
  - Treatment
- Itching
- Delirium



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Assessment of the PCA patient

Care of the complex patient

- Pediatrics
- Geriatrics



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Assessment of the PCA patient

PCA surrogacy

- PCA relies on negative feedback loop
  - If too sleepy, can't push the button
- Pediatrics
  - ISMP assessment
  - PCCU assessment



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Assessment of the PCA patient

PCA surrogacy

- Adults
  - Lock out mode as a safety feature

Balance of treatment efficacy vs side effects

- Utilization of multimodal therapy



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**Assessment of the PCA patient**

**Utilization of multimodal therapy**

- Management of the complex patient
  - Dosing
  - Delivery
    - Matching opioid demand to pump delivery capabilities



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**Multidisciplinary approach to pain management**

- Purpose of gathering the team:
  - Explain the technology & pharmacology
  - Develop objectives
  - Plan enduring training for all caregivers
    - Orientation
    - Yearly competencies
    - Web-based or hands-on or both
    - Remediation



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**Implementation of smart pump technology**

- Steering committee
- Interdisciplinary effort
  - RFI – functionality, integration, safety
  - Order Sets, CPOE
  - Drug library creation
    - Translation of order sets, drug information



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**Implementation of smart pump technology**

**Drug library creation**

- Translation of order sets, drug information
- Linkage between drug files and bar codes
- Allowance for wild card settings
- Hard stops vs soft stops
- Lockouts



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**Implementation of smart pump technology**

**Drug library creation**

- Definition of special populations
  - Adults
  - Pediatrics
  - Opioid naïve
  - Opioid tolerant
  - Sickle Cell crisis
  - Crisis



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**Implementation of smart pump technology**

**Drug library creation**

- Staff Training
  - Web tools
  - Hands on
  - Simulation
  - Enduring training



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### Monitoring of smart pump technology

Quality Improvement:

- Wireless functionality = data transfer
- Data to the pump
- Data from the pump
- Patient assessment = profile selected = dosing



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### Monitoring of smart pump technology

Integration with clinical systems

- Closed loop with CPOE/Pharmacy
  - Automated initial programming
- Closed loop with Nursing documentation systems
  - Automated treatment programming based on assessment based on EBM algorithm



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### Conclusions

- Remember impacts of People, processes, and systems
- Structure to maintain communication
- Literature of pain management ever changing
- Focus on the patient and best treatment



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## References

*References used in this presentation  
are available on a separate handout.*



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