A problem oriented software application for peri-anesthetic care

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Introduction

- Until 2010 - recovery unit medical record was based on paper work
- Other wards are using electronic medical record (EMR)
- A decision to have EMR in recovery unit and ICU was made
The benefits of EMR

- Paperless - environmental friendly
- Data base - easy to access and retrieve information
- Comfortable display
- Comprehensive information
Goals

- Improve patient safety
- Support quality initiative

Aims

- To create a problem oriented care plan for patients in the recovery unit
- To reduce information loss at handoffs between OR, recovery unit and ICU
Methods

- Characterization of existing workflow
- Development of variety of post surgical care plans
- Developing and designing software menus, tools, calculators, scores and methods
- Implementation of Metavision software
Characterization of Existing Workflows

daily manual filling - Tracking sheet (green) admission to Recovery unit pre-operative /new patient

Documenting vital signs, medications, fluids, Monitor the patient Daily via Tracking Sheet

Fill order to medicines and fluids, Signed by the physician
The Nature of change

- The Transition to a computerized system is not only to abandon pen and paper, but an opportunity to reconsider, think, and change work processes.
Design New Workflows Processes

Arrival of a patient from surgery, adding automatically record of the patient's data to recovery department list of patients. Computer data (patient name, ID, date and time of entry and recovery)

dragging Patient in Surgery Chart screen, from Transfer bed to a suitable bed At the Recovery by a doctor / nurse

The patient is expected to remain above 24 hours at the Recovery, according to the criteria : Type of surgery, age, medical history, course of surgery.
Computing Recovery Unit

- A customized system that analyzes the various types of surgeries throughout the admission, hospitalization and discharge from the recovery unit
- Documentation and follow up according to the type, severity of surgery and Length of stay
- Building continuity of care from surgery to recovery and transfer to ICU
- Releasing the recovering patient to the surgical departments
Metavision

- A clinical information system for the critical care environment.
- Collects, presents, stores, and analyzes the vast amount of patient-related data generated in the ICU
<table>
<thead>
<tr>
<th>advantages</th>
<th>Qualities</th>
</tr>
</thead>
<tbody>
<tr>
<td>All data is inserted automatically and concentrated in one place</td>
<td>Comprehensive computerized report on a patient</td>
</tr>
<tr>
<td>End of Archive searches and many cumbersome forms</td>
<td>Patient history retrieval</td>
</tr>
<tr>
<td>Comfortable display of data, error prevention</td>
<td>Providing user management tasks and activities</td>
</tr>
<tr>
<td>End of calculation of fluid balance</td>
<td>Automatic calculations</td>
</tr>
<tr>
<td>Clear &quot;hand&quot; writing</td>
<td>Clinical Notes, a list of problems and diagnoses</td>
</tr>
</tbody>
</table>
Data Collection

The system collects:

- Vital signs from monitors
- Laboratory study results
- Respirator parameters data
- IV pumps data
- Information from hospital information system

The data is collected minute by minute
Software Specialty

- Downloading data automatically without human involvement from the monitors, respirators and more adapted equipment
- Nursing staff confirms the data on time according to Standards unit policies
# Data Display

**Cardio Vascular**
- Invasive Blood Pressure: 55, 59, 64, 53, 51, 63, 48, 56, 60, 60, 52, 56, 59, 61, 50, 59, 66, 64, 61, 66, 48, 63, 64, 67, 67, 74, 76, 71, 71, 77, 78, 55, 75, 63, 70, 67, 77...
- HR: 88, 88, 93, 92, 97, 88, 97, 91, 93, 94, 98, 94, 91, 99, 93, 92, 93, 92
- Pulmonary Artery Pressure

**Respiratory Parameters**

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**Diagrams showing trends over time**

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**Additional Information**
- 15
- The Lady Davis Carmel Medical Center, Haifa, Israel
- CLALIT 100 years
- From the Bottom of Our Heart
- 13.23 13/10/2011
- Next Visit Date: 16/10/2011
Software customization

- A unified platform for the three units
- Each unit uses some of the menus
- Users can distinguish between units by the different layouts
- The result is a unified peri-anesthesiology computerized medical record
Characterization of New Workflow Processes

Transferring a patient to the recovery unit

1. Release from the operation room
2. Admission to recovery room
3. Receive Group of instruction at the Transfer from operation room
4. connecting to the respirator and monitor
5. Identifying the right patient at the right bed
   - emphasize: Work with the patient's bedside, right file
6. Routine Ratification of data on postoperative patient
7. Filling specific nursing instructions according to surgery type
8. Special patient at the recovery room
9. Staying over 24 hours at recovery

Special patient at the recovery room

- Staying over 24 hours at recovery
Special Admissions to Recovery Unit

Patients discharged from the recovery And back due to relapse

- open previous file. Marking an event back to recovery

Patients arriving from outside the operating: Daycare unit Radiology department E.R.C.P etc....
Transfer A Patient From the Recovery to ICU

Transfer Patient from recovery to intensive care unit

- Making medical and nursing admission
- No release letter from recovery on - MV
- Release the patient file on MV at recovery room
- Opening a patient file at ICU, in MV, transfer continuing orders
- Order that are not continuing, are not pass
- Making assessment of the patient at the arrival
- Continued documentation from the sequel treatment
Intervention

- Introducing different types of programs
- Building different layouts based on the Length of recovery time after various surgeries
- Monitoring patients in various degrees of complexity, type and severity of the surgery
Layout of Surgery Room at EMR
Handoff Patients From Surgery to Recovery in EMR

- Transfer from surgery to the recovery unit, while maintaining a sequence of continuous treatment.
- There is an ability to track the ongoing events in the operating room and the continuous care.
- Connecting the Patient to monitoring devices, Data starts to flow.
PACU - Recovery Unit

From OR to Transfer Beds
Care plans menus

- The recovery unit team created a comprehensive care plan for every post-surgical and intervention type
The platform contains 10 different care plans that support all post surgical interventions.

The care plan menus are easily adjusted in order to meet the problems and needs, that develop during the patients stay in the recovery unit.
Admitting Patient to Recovery

### Aldrete Score

<table>
<thead>
<tr>
<th>Component</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturation</td>
<td></td>
</tr>
<tr>
<td>Blood Pressure</td>
<td></td>
</tr>
<tr>
<td>Level of Consciousness</td>
<td></td>
</tr>
<tr>
<td>Breathing</td>
<td></td>
</tr>
<tr>
<td>Muscles function</td>
<td></td>
</tr>
</tbody>
</table>

### Assessment Patient at Recovery

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Consciousness</td>
<td></td>
</tr>
<tr>
<td>Type of Anesthesia</td>
<td></td>
</tr>
<tr>
<td>Drains</td>
<td></td>
</tr>
<tr>
<td>Breathing Form</td>
<td></td>
</tr>
<tr>
<td>Skin Color</td>
<td></td>
</tr>
<tr>
<td>Surgical Incision</td>
<td></td>
</tr>
<tr>
<td>Extubation time</td>
<td></td>
</tr>
</tbody>
</table>

**Example:**

- Date: 13/06/2004
- Time: 09:53
Patient Care Management
Microsurgery

admitting patient from microsurgery

- Motility
- Temperature
- Color
- dopler
- Capillary filling
- Comments...
# Vascular Assessment

## Neurological Assessment

- **Left Foot**
  - Tendon Reflex: Normal
  - Muscle Tone: Normal
  - Sensation: Normal
- **Right Foot**
  - Tendon Reflex: Normal
  - Muscle Tone: Normal
  - Sensation: Normal

## Vascular Assessment

- **Left Popliteal**
- **Lt Tibialis Posterior**
- **Rt Popliteal**
- **Rt Tibialis Posterior**
Orthopedics

Left hand mobility

Left leg mobility

Left capillary filling

Left limb color

Right hand mobility

Right leg mobility

Right Capillary filling

right limb color
Gynecology

- Uterine contraction
- Gynecologist examination
- Transvaginal ultrasound
- Surgical incision
- Vaginal bleeding
Transferring a Patient From Surgery to Recovery Unit
Transferring Children From Surgery to the Recovery Unit
**orders**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Amount</th>
<th>Rate</th>
<th>Infusion Time</th>
<th>Delivered</th>
<th>Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose 5% Saline</td>
<td>1,100</td>
<td>50 ml</td>
<td>15 min</td>
<td>1,100</td>
<td>0</td>
</tr>
<tr>
<td>Ringer's lactate</td>
<td>900</td>
<td>50 ml</td>
<td>15 min</td>
<td>900</td>
<td>0</td>
</tr>
<tr>
<td>Morphine</td>
<td>150 mg</td>
<td>20 ml/h</td>
<td>120 min</td>
<td>150</td>
<td>0</td>
</tr>
<tr>
<td>Trometol</td>
<td>60 ml</td>
<td>10 ml/h</td>
<td>60 min</td>
<td>60</td>
<td>0</td>
</tr>
<tr>
<td>Potassium Chloride</td>
<td>30 ml</td>
<td>10 ml/h</td>
<td>30 min</td>
<td>30</td>
<td>0</td>
</tr>
<tr>
<td>Zantac-Fenostidine</td>
<td>50 mg</td>
<td>5 ml/h</td>
<td>10 min</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>Furosemide</td>
<td>50 ml</td>
<td>10 ml/h</td>
<td>60 min</td>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>Cefuroxime</td>
<td>100</td>
<td>10 ml/h</td>
<td>100 min</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

**Additional Information**

- Mixed solution: Sodium Chloride 0.9% (100 ml at 100 ml/h)
- Duration: 1 hour(s)
- Section details:
  - Zantac-Fenostidine (50 mg at 50 mg/h)
  - Insulin Soluble (50 U at 50 U/h)
- Section start time: 08/08/2013 14:49
- Section start time: 08/08/2013 14:49

**Notes:**

- Over Night: Yes
- Day: 43
- PACU: 10:59 08/08/2013
Discharge Documentation From Recovery

- Discharge letter from recovery contains: Medical and nursing information
- Summarizes the duration of stay in the operating and recovery room
Discharge of Patient From the Recovery Unit to the Departments

Fill group of release instructions
- Continuous orders
- Medical instruction
- Provision of Oxygen
- Continuous antibiotics
- Continuous fluids
- Connecting to monitor
- Pain treatment- PCA
- ALDRETE
- ALDRETR
- Bleeding check
- check surgical incision

After the above tests
the patient is released by
changing the status on the
patient file
Discharging the Patient From the Recovery Unit
Discharge Letter From Recovery
Discharge Documentation
### Admission - Aldrete

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Aldrete</td>
</tr>
<tr>
<td>Admission Date</td>
<td>06/03/2013 13:00</td>
</tr>
</tbody>
</table>

### Discharge - Aldrete

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Aldrete</td>
</tr>
<tr>
<td>Discharge Date</td>
<td>06/03/2013 13:15</td>
</tr>
</tbody>
</table>

### Drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Type</th>
<th>Infusion Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propofol</td>
<td>20 mg</td>
<td>I.V.</td>
<td>20/06/2013 12:16</td>
</tr>
<tr>
<td>Midazolam</td>
<td>1 mg:1 ml</td>
<td>(1 ml Other fluid)</td>
<td>I.V. 20/06/2013 12:16</td>
</tr>
<tr>
<td>Midazolam</td>
<td>1 mg:1 ml</td>
<td>(1 ml Other fluid)</td>
<td>I.V. 20/06/2013 11:22</td>
</tr>
</tbody>
</table>

### Vital Signs

- **Blood Pressure**: 122/71
- **HR**: 67
- **SpO2**: 93.6

### Pain Scale

- **VAS (Visual Analog Scale)**: 0

- **ICU**

- **Additional Information**: 
  - GCS: 14
  - Medication: Midazolam 1 mg I.V.
  - Procedures: None

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**Drugs**

- **PUSH**: 
  - Propofol 20 mg I.V.
  - Midazolam 1 mg:1 ml I.V.
  - Midazolam 1 mg:1 ml I.V.
We received feedback from surgical departments about the improvements and Clarity of the letter.
# Medical orders

## Medical instructions

<table>
<thead>
<tr>
<th>Medical orders</th>
<th>Respiratory instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drugs</td>
<td></td>
</tr>
<tr>
<td>Order Entry</td>
<td></td>
</tr>
<tr>
<td>Triage</td>
<td></td>
</tr>
<tr>
<td>ICU</td>
<td></td>
</tr>
<tr>
<td>CVS</td>
<td></td>
</tr>
<tr>
<td>CNS</td>
<td></td>
</tr>
<tr>
<td>O2</td>
<td></td>
</tr>
<tr>
<td>Drug Antibiotics</td>
<td></td>
</tr>
<tr>
<td>Drugs Antibiotics</td>
<td></td>
</tr>
</tbody>
</table>

## Fluids and nutrition

<table>
<thead>
<tr>
<th>Fluids and nutrition</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Order Entry</td>
<td></td>
</tr>
<tr>
<td>Triage</td>
<td></td>
</tr>
<tr>
<td>ICU</td>
<td></td>
</tr>
<tr>
<td>CVS</td>
<td></td>
</tr>
<tr>
<td>CNS</td>
<td></td>
</tr>
<tr>
<td>O2</td>
<td></td>
</tr>
<tr>
<td>Drugs and Antibiotics</td>
<td></td>
</tr>
</tbody>
</table>

---

Note: The image contains a chart with medical instructions and respiratory instructions, but the text is not fully transcribed here due to the complexity of the layout and the need for specific knowledge to interpret it accurately.
Respiratory orders

### Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal Volume</td>
<td>ml</td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEEP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I/Time I/E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FIO2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Type of respiration

- **Respirator**

### Alarms

- **Insp. Pressure High**
- **Insp. Pressure Low**
- **Minute Volume High**
- **Minute Volume Low**

### Respiratory System
# More About Medication

![Image of medication management software interface](image)

## Example Table for Medication Management

<table>
<thead>
<tr>
<th>Medication</th>
<th>Quantity</th>
<th>Unit</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium Chloride 0.9%</td>
<td>50 ml</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heparin (units)</td>
<td>10000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Additional Information
- **Warning**: Always consult with a healthcare professional before administering medication.
- **Dosage**: Adjust based on patient's condition and medical history.
- **Side Effects**: Monitor for any adverse reactions.

---

**Note**: The above information is for educational purposes only and should not replace professional medical advice.
Orders List

<table>
<thead>
<tr>
<th>Time</th>
<th>Route</th>
<th>Dose</th>
<th>Duration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/08/2013 15:00</td>
<td>1000 ml</td>
<td>100 ml</td>
<td>04/08/2013 15:00</td>
<td></td>
</tr>
<tr>
<td>04/08/2013 12:48</td>
<td>1000 ml</td>
<td>625 ml</td>
<td>04/08/2013 12:48</td>
<td></td>
</tr>
<tr>
<td>04/08/2013 11:30</td>
<td>1000 ml</td>
<td>614 ml</td>
<td>04/08/2013 11:30</td>
<td></td>
</tr>
<tr>
<td>04/08/2013 11:02</td>
<td>1000 ml</td>
<td>20 ml</td>
<td>04/08/2013 11:02</td>
<td></td>
</tr>
<tr>
<td>04/08/2013 10:41</td>
<td>1000 ml</td>
<td>1,071 ml</td>
<td>04/08/2013 10:41</td>
<td></td>
</tr>
<tr>
<td>04/08/2013 10:25</td>
<td>1000 ml</td>
<td>500 ml</td>
<td>04/08/2013 10:25</td>
<td></td>
</tr>
<tr>
<td>04/08/2013 10:00</td>
<td>1000 ml</td>
<td>100 ml</td>
<td>04/08/2013 10:00</td>
<td></td>
</tr>
<tr>
<td>04/08/2013 09:43</td>
<td>200 ml</td>
<td>200 ml</td>
<td>04/08/2013 09:43</td>
<td></td>
</tr>
<tr>
<td>04/08/2013 08:34</td>
<td>25 ml</td>
<td>25 ml</td>
<td>04/08/2013 08:34</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 18:04</td>
<td>25 ml</td>
<td>25 ml</td>
<td>05/05/2013 18:04</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 11:30</td>
<td>1 mg/mL</td>
<td>1 mg/mL</td>
<td>05/05/2013 11:30</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 18:40</td>
<td>25 IU/mL</td>
<td>25 IU/mL</td>
<td>05/05/2013 18:40</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 11:51</td>
<td>25 IU/mL</td>
<td>25 IU/mL</td>
<td>05/05/2013 11:51</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 16:00</td>
<td>1,000 units/mL</td>
<td>1,000 units/mL</td>
<td>05/05/2013 16:00</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 18:17</td>
<td>100 mg/mL</td>
<td>100 mg/mL</td>
<td>05/05/2013 18:17</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 18:17</td>
<td>200 mg/200 ml</td>
<td>200 mg/200 ml</td>
<td>05/05/2013 18:17</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 12:00</td>
<td>2.5 mg</td>
<td>2.5 mg</td>
<td>05/05/2013 12:00</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 11:51</td>
<td>5 mg/mL</td>
<td>5 mg/mL</td>
<td>05/05/2013 11:51</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 13:05</td>
<td>5 mg/mL</td>
<td>5 mg/mL</td>
<td>05/05/2013 13:05</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 12:50</td>
<td>5 mg/mL</td>
<td>5 mg/mL</td>
<td>05/05/2013 12:50</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 11:20</td>
<td>5 mg/mL</td>
<td>5 mg/mL</td>
<td>05/05/2013 11:20</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 12:00</td>
<td>50 mcg/mL</td>
<td>50 mcg/mL</td>
<td>05/05/2013 12:00</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 12:45</td>
<td>200 mg/mL</td>
<td>200 mg/mL</td>
<td>05/05/2013 12:45</td>
<td></td>
</tr>
<tr>
<td>05/05/2013 11:14</td>
<td>500 mcg/mL</td>
<td>500 mcg/mL</td>
<td>05/05/2013 11:14</td>
<td></td>
</tr>
</tbody>
</table>
Orders Reminder

The software simplifies and enhances perianesthetic care and contributes to patient safety and quality of care.
# Medical Orders

![Medical Orders interface](image)

## Insulin Soluble
- **Insulin Soluble**

## Fluids
- **Sodium Chloride 0.9%**
- **Pulmocare**

## Non IV medication
- **Tienam**
- **Warfarin - Coumadine**
- **Esomeprazole-Nexium**
- **Cordina - drug push**
- **Metoprolol**

### Pulmocare (650 ml)
- **Total**: 650 ml at 65 ml/hr
- **Duration & Hour(s)**: 56 Min(ute(s)
- **Location**: P2; Continuous

### Pulmocare (444.5 ml)
- **Total**: 444.5 ml at 65 ml/hr
- **Duration & Hour(s)**: 64 Min(ute(s)
- **Section start time**: 17/10/2011 2:35

---

### Pulmocare Details
- **402 IU**
- **3.203 ml**
- **21.5/75.4 ml**
- **1168 ml/hr**
- **184 ml/hr**
- **164 ml/hr**
- **18 mg**
- **164 ml/hr**
- **4 mg**

---

**Date and Time**: 17:24 24/08/2011

**Author Information**: 19:32 17/10/2011
Apache II Score
acute physiology and chronic health evaluation
More Advantage

- A tool to implement treatment
- Helps promoting standards of care in the unit

Less time on documentation
More time for patient care
MV - Interfaces to

"RIS" Radiology system (X-ray, CT scans, u/s)

"Horizon" interface (Clinics and Hospitals)

Hospital system (HIS)

System Laboratories
Results

- The implementation process was accomplished in 2011 and resulted in paperless peri-anesthetic medical records.

- The unified patient record enables a smooth handoff from the OR to the recovery room and to the ICU and vise versa.
Results Continues

- A unified record is also useful for staff rotation between the units.
- The customized care plan have improved patients safety, and enhanced recovery unit nurses ability, to detect the onset of complications.
Achieving Excellence at Computerization Requires: Work of the multidisciplinary team

What is needed?
Designing, implementing & improving the programs for Medical staff
Conclusions

- Implementation, adaptation and customization of perianesthetic software requires a multidisciplinary development team.

- The lack of shelf software for recovery unit, requires customization and development of an innovative application that is a milestone in perianesthetic software development.
Summary and future plans

Ongoing updates and upgrade

computing additional units:
- Heart surgery Intensive care
- Cardiology
- Nicu: Neonatal intensive care unit
“In order to analyze the causes of the disease - science is necessary. In order to understand the patient - philosophy is necessary. And in order to treat a person - humanity is necessary.

Therefore one can say that:
Medicine without science is powerless,
Medicine without philosophy is meaningless,
And medicine without humanity is soulless.”

DR HIROSHI TAKASHUMA
Thanks for Listening and Enjoy the Conference