Do “Lean” Projects Affect Resident Education?

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Turning Production Pressure into Production Planning

Production Pressure

OR Efficiency

Surgeon
Value-Added
Time

Anesthesia
Value-Added
Time

Production Pressure

OR Efficiency

Surgeon
Value-Added
Time

Anesthesia
Value-Added
Time

Production Pressure

OR Efficiency

? Education

Conflict

Surgeon
Value-Added
Time

Anesthesia
Value-Added
Time

Production Pressure is a detriment to:

- Good patient care
- Safety
- Resident education

Production Planning

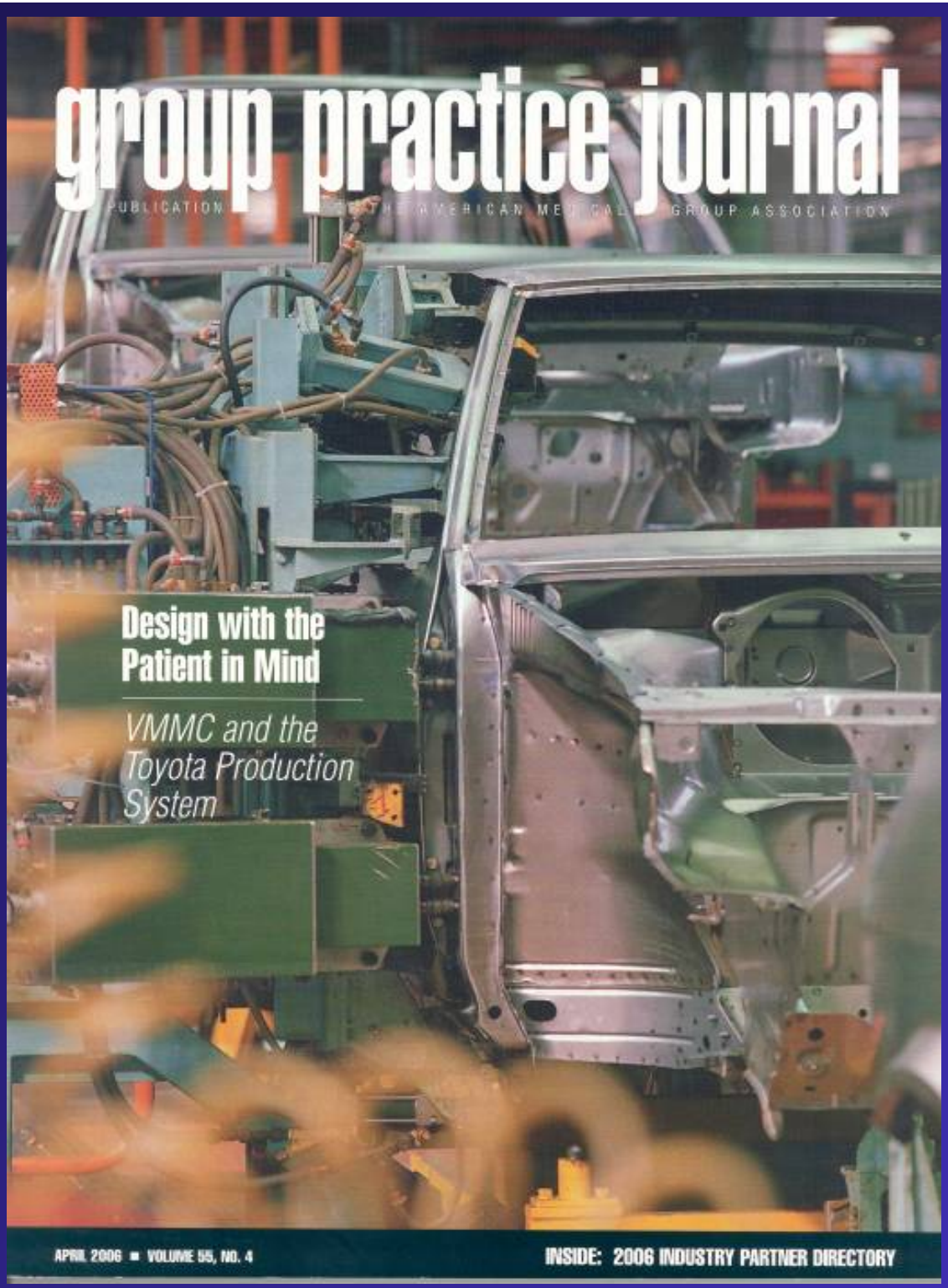
OR Efficiency

Surgeon Value-Added Time

Anesthesia-Education Value-Added Time

Today's Talk:

- Addressing Production Pressure in education
- Brief history of Lean Process improvement
- Waste in resident education
- Hardwiring education in the process
  - Learning modules; simulation
  - Planning: knowing your cycle times
  - Signaling
  - Standard work
  - OR Cells
- Explicit training and being a doctor: Standard Work
- Use of the Value Stream in Education
- Process improvement is Systems-Based Learning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Design with the Patient in Mind
VMMC and the Toyota Production System
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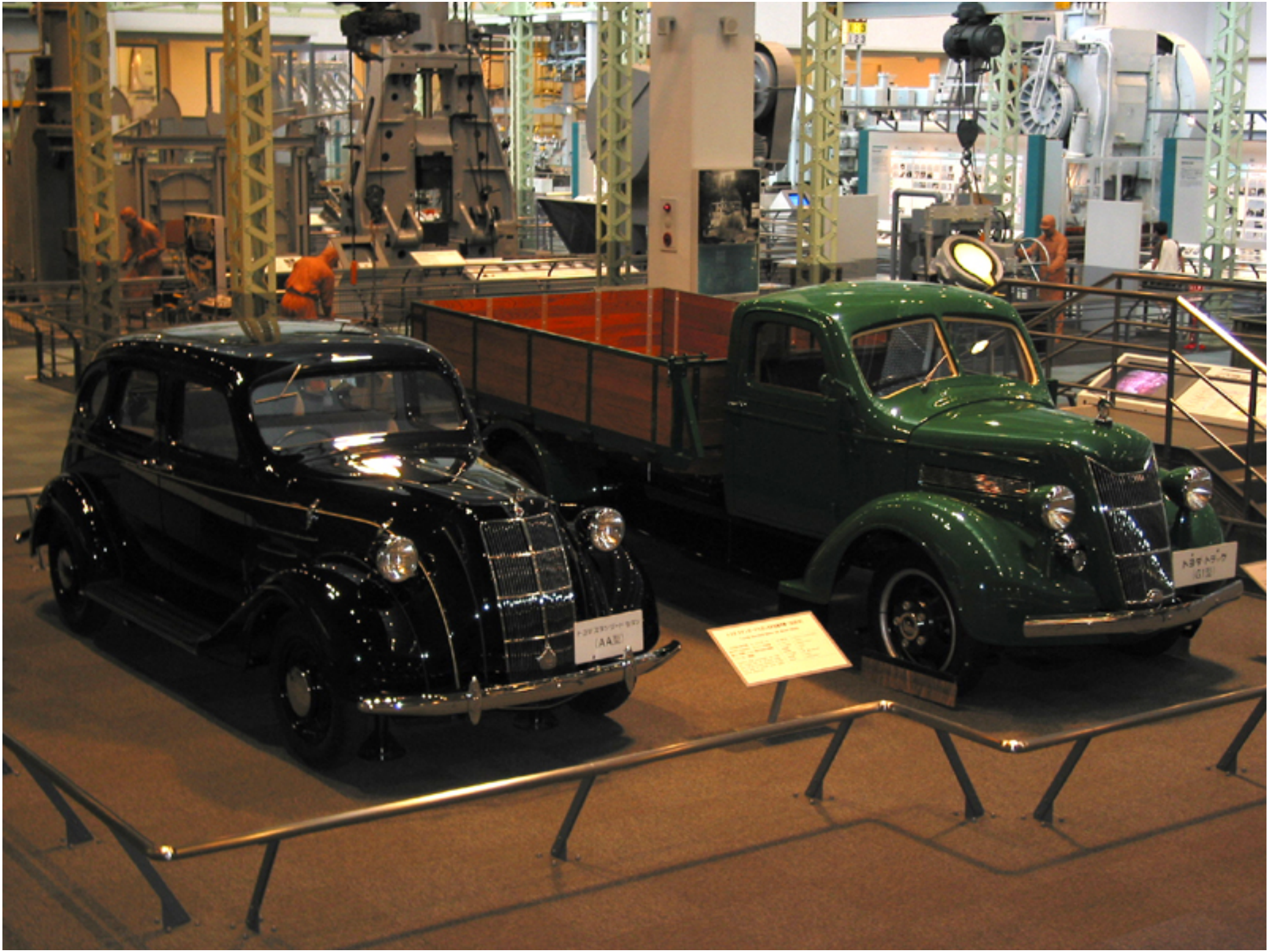


“Lean” is based on the Toyota Production System

- 19th-Century Toyoda family was an innovative producer of looms
- Turned Loom fortune into making cars
- Taiichi Ohno: a production engineer at Toyota motor company
- A new set of production rules to allow Japan to compete after WWII

“Lean” Applied to Medicine

- A safety strategy
- A quality strategy
- An efficiency strategy
- A strategy to support education
  - Less wasted time, resources
  - Quality time with patients
  - Finding what you want
  - Learning how systems work together

Lean is a suite of tools to improve quality and efficiency

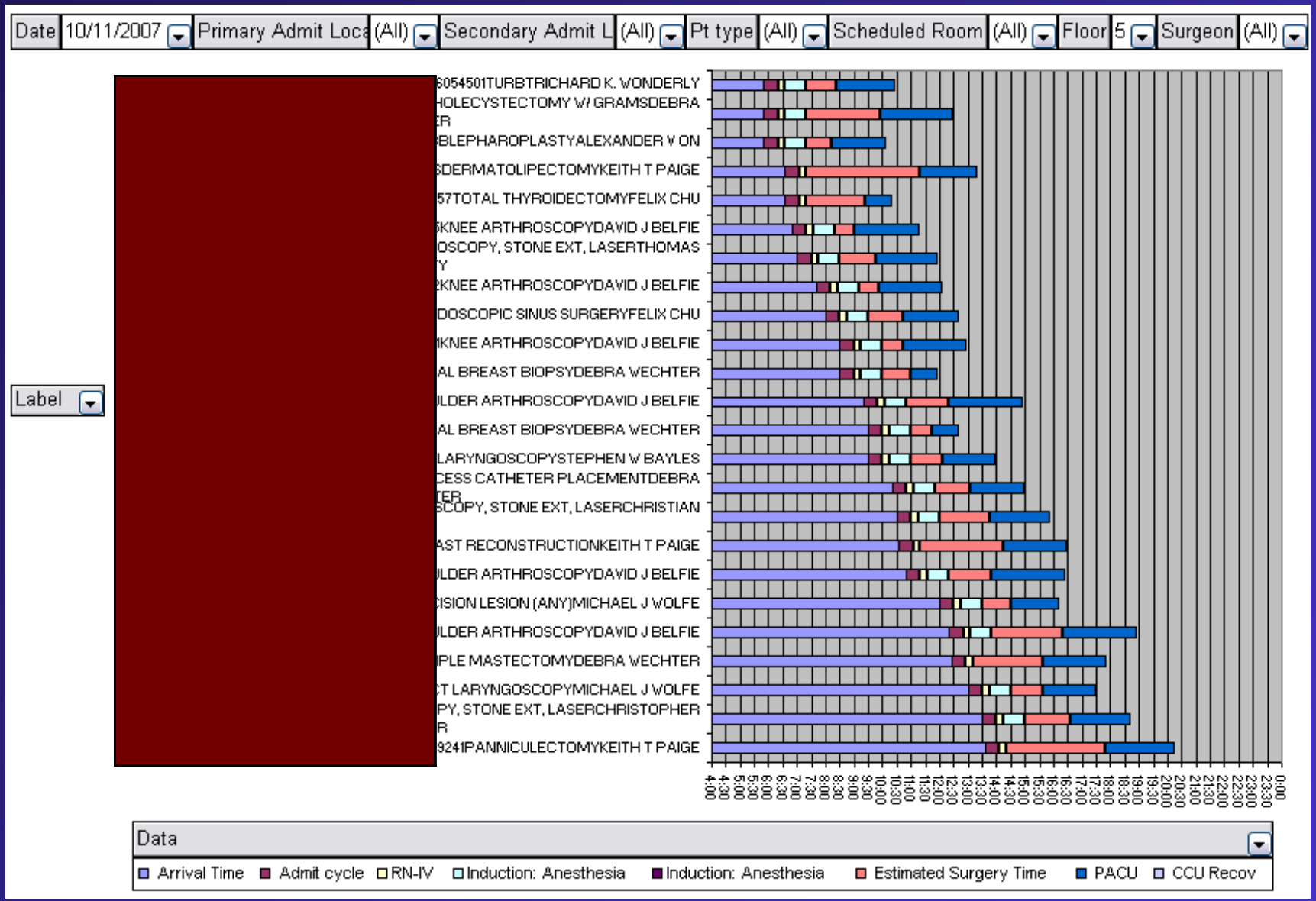
- Waste reduction
- Creation of flow
- Pull vs. push
- Just-in-time delivery
- Everything in its place
- Visual control
- Signaling
- Mistake proofing
- Autonomation
- Stop-the-line
- Standard operations
- Externalizing set-up
- Level-loading

Taiichi Ohno's Seven Wastes

Waste in Resident Education:

- Waiting
- Delays:
  - Information; labs
  - equipment
  - patient
  - surgeon
  - communication
- Travel: distances
  - clean up
  - drug access
- Defects:
  - Missing information
  - Catheters that don't work
  - Medical errors
- Cases/days that run long due to poor planning
  - fatigue
  - reading loss
  - exercise loss
  - family connection

Production Planning: Waterfall Schedule



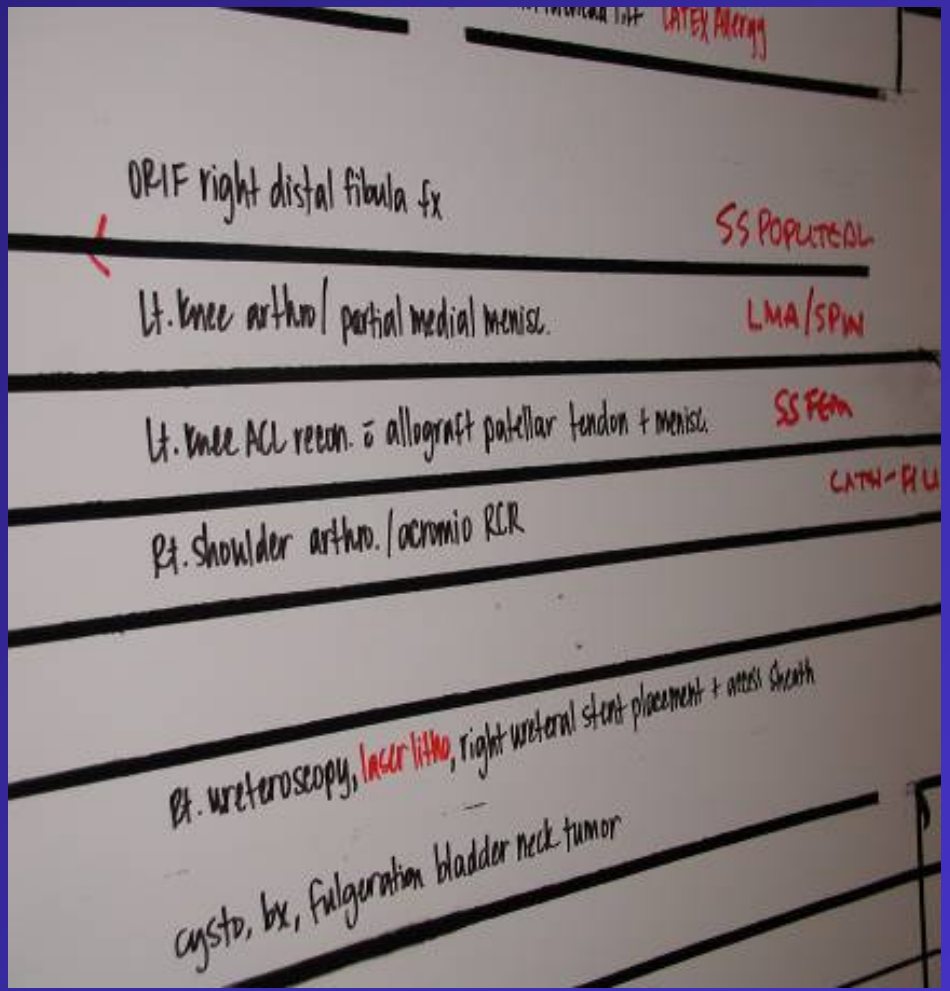
Waterfall Schedule's Impact

- Improves Staffing Assignments
- Bed Placement Predictability
- CCU Impact, preplanning
- Transport and other support services can adjust as needed

Visual Control

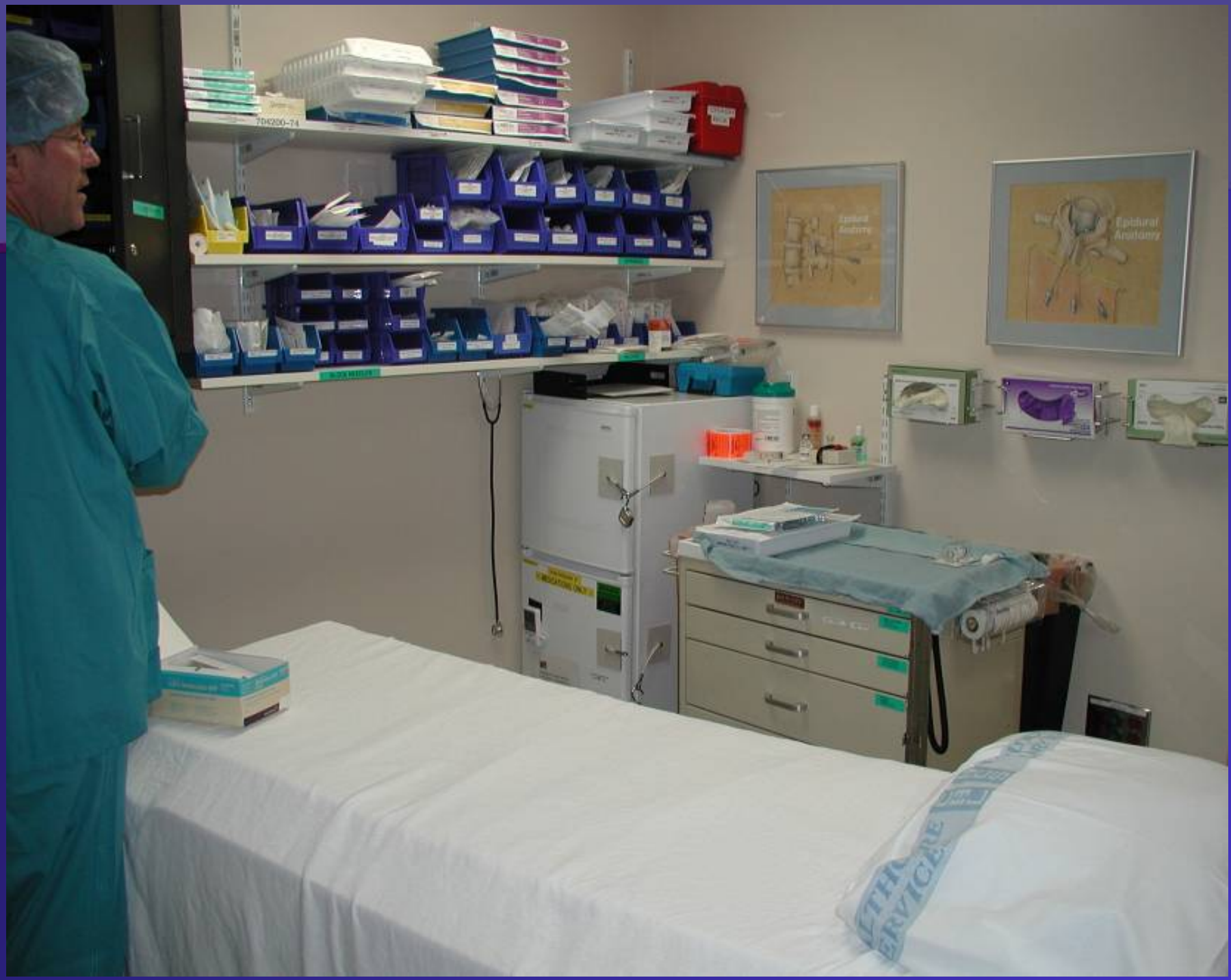
Visual Control: the Anesthesia Plan

- Ahead of time
- Discussed with surgeon
- All members of the team can see and plan accordingly

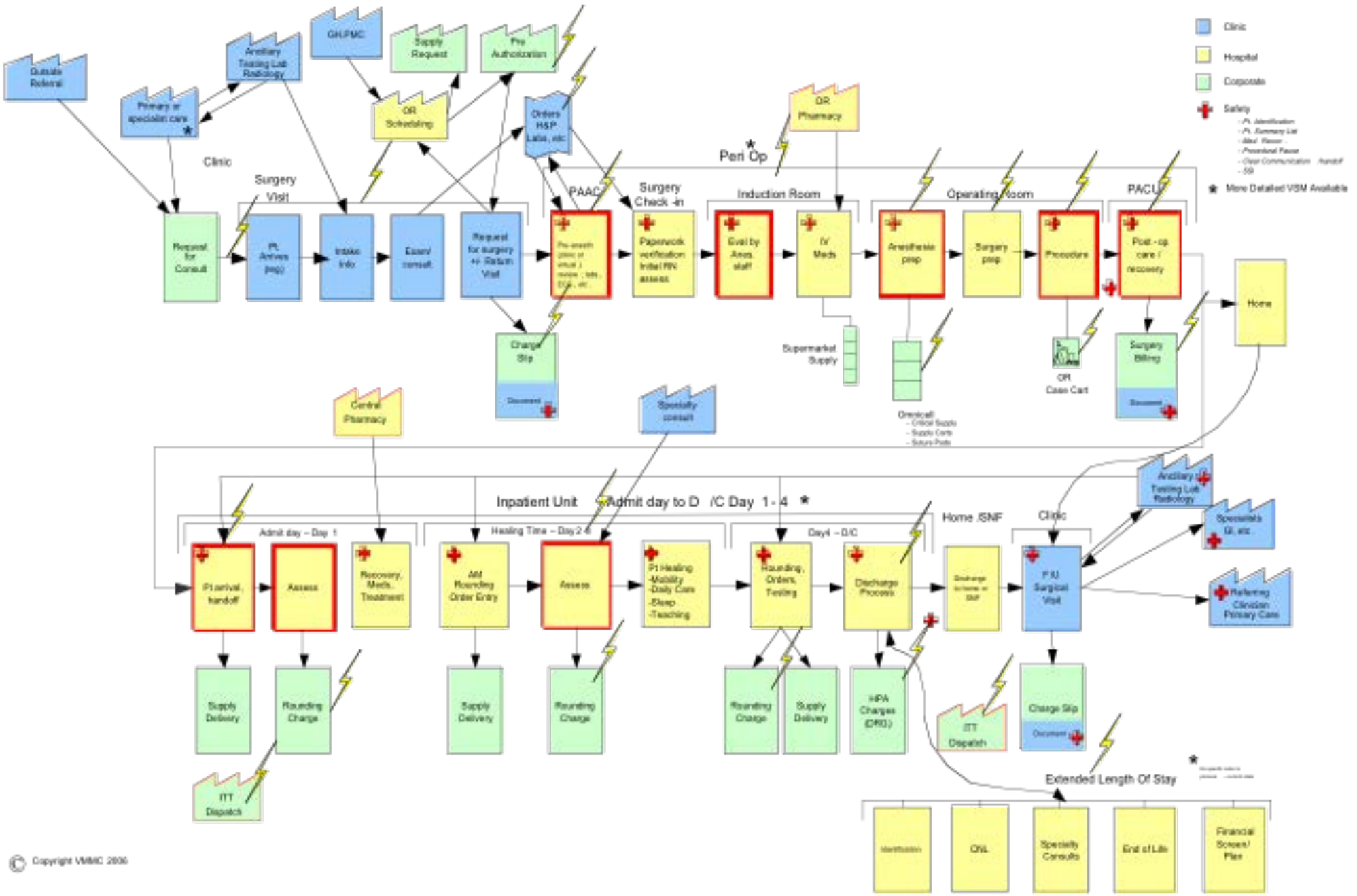


External Set-up is a Key

- Same as “parallel processing”
- Knowing as much about the patient and the process is fundamental

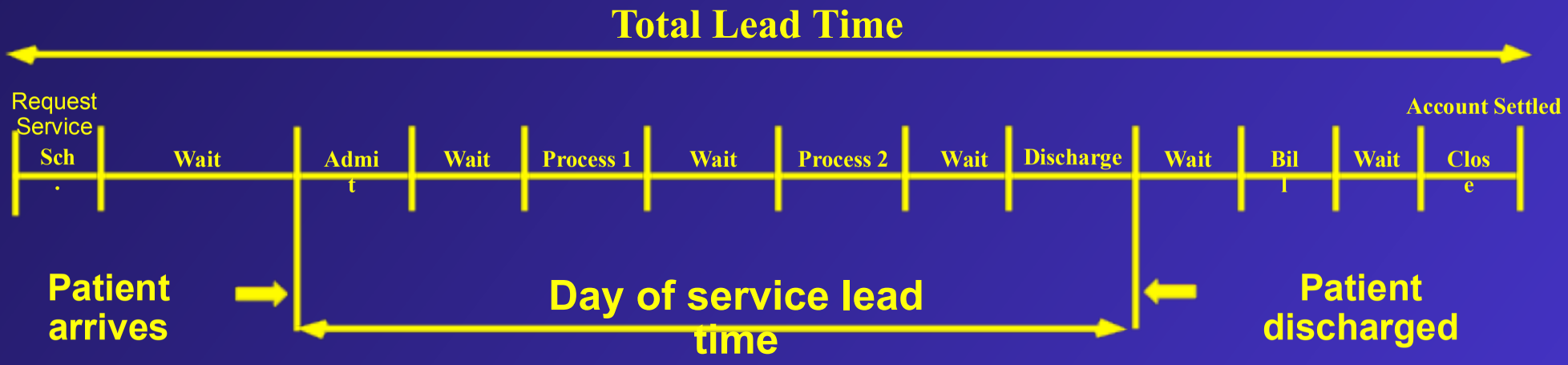

Epidural Anatomy
Epidural Anatomy

SURGICAL SERVICES MODEL LINE VALUE STREAM MAP
Focus Area : General Surgery DRAFT 10/23/06



You must be willing to measure

- Sequences of activity
- Cycle times
- Critically asses what is value-added and what is not


Total Lead Time
Request Service
Sch.
Wait
Admit
Wait
Process 1
Wait
Process 2
Wait
Discharge
Wait
Bill
Wait
Close
Account Settled
Patient arrives
Day of service lead time
Patient discharged

Measured Prep Area Cycle Times:

Task	Minutes
IRN interview	5:54
iv placement	6:59
ORN interview	2:30
Anesthesia Interview	7:06
Epidural placement	30:06
Spinal block	15:08
Brachial Plexus block	24:52
Femoral Nerve catheter	21:05

The Resident-Attending Must Be Ready

Learning Modules (e.g.Difficult Airway)

- Web based learning module
  - Didactic interactive with atlas
  - Head and Neck tutorial
- Basic Airway Rotation

External Set-up: Simulation Training Safety Steps are Mandatory

1. Wash hands
2. Chlohexidine prep
3. Max barrier protection
4. Optimal site for cath
5. Ultrasound for IJ
6. Venous confirmation
7. Daily assessment for need

Preparation for Femoral Nerve Catheter Placement

1- Identify patient, site, and side of surgery and perform a procedural pause

2 - Set up equipment. (US machine contralateral, tray ipsilateral)

3 - Open selected block tray, thread catheter through needle and flush assembly with local anesthetic or D5W

4 - Palpate the femoral artery in the inguinal crease. If available perform an US survey scan

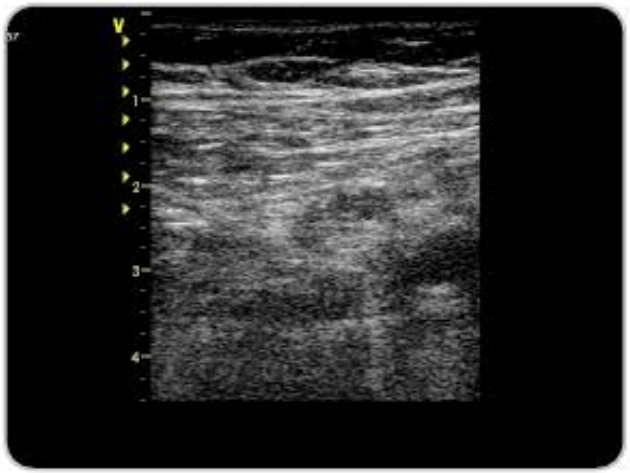
5- If used, mark the footprint of the ultrasound probe

6- Prepare and drape the skin in the usual fashion

7 - If used, place a sterile sleeve over the US probe with gel

8 - Relocate the femoral nerve paying close attention to the location of the fascia iliaca

9 - For US guidance use an IN-PLANE approach keeping the entire needle in view at all times



10 - Place needle/catheter at the posterior/lateral edge of the femoral nerve ensuring that catheter remains below the fascia iliaca and assess local anesthetic spread

11 - Affix the catheter to the skin with Mastasol and Tegaderm keeping in mind the placement of the thigh tourniquet

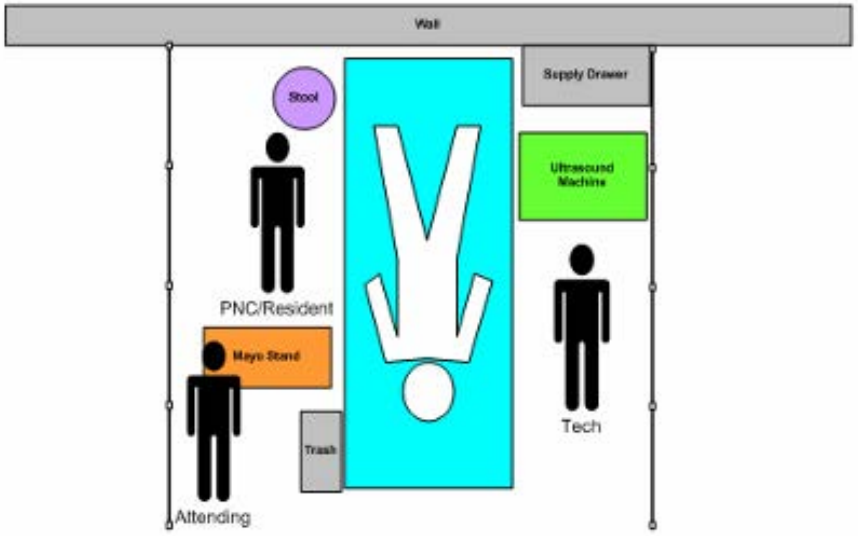
12 - Assess block. Document block on anesthesia record. Obtain ropivacaine 0.2% and place orders in Cerner

Establish Standard Work: Femoral Nerve Catheter Placement

Parallel Processing of FNC and Spinal Block Placement

Time (min)	Anesthesia Tech	Attending	PNC/Resident	
Respond to page within six min.				
1	Set up Ultrasound	Interview	(PNC) Introduction	
2			Get Meds	
3				
4	Get tray/gloves			
5	Set up tray			
6			Pause	
7		Position PT	Establish landmarks	
8		Pulse Ox/ O2 mask		
9	Prep PT	Sedation, monitoring		
10			Gloves	
11			Draw Meds	
12				
13		Drape	Drape	
14	Sleeve on Ultrasound	Teach, assist	Sleeve on Ultrasound	
15	Adjusting ultrasound IF needed		Conduct block	Resident
16				Transport previous patient to PACU and PACU handoff
17				
18				
19				
20				
21				
22	Remove ultrasound		Secure catheter	
23	Clean up tray	Clean up Patient		
24	Spinal tray set up	Position PT	Get infusion and pump (End PNC)	Introduction
25	Prep PT	Teach, monitor, assist		Gloves
26	Assist IF needed			Drape
27			Draw Meds	
28			Conduct Spinal	
29				
30				
31				
32		Clean up tray	Clean up PT	
33		Reposition	Reposition	
34	Transport PT to room			

Anesthesia Tech Standard Set-up
FNC and Spinal Block Placement
(left sided FNC)



Equipment and Supply Checklist

Equipment
- Mayo stand
- Sitting stool
- Trash can
- Ultrasound machine (plug in and boot up)

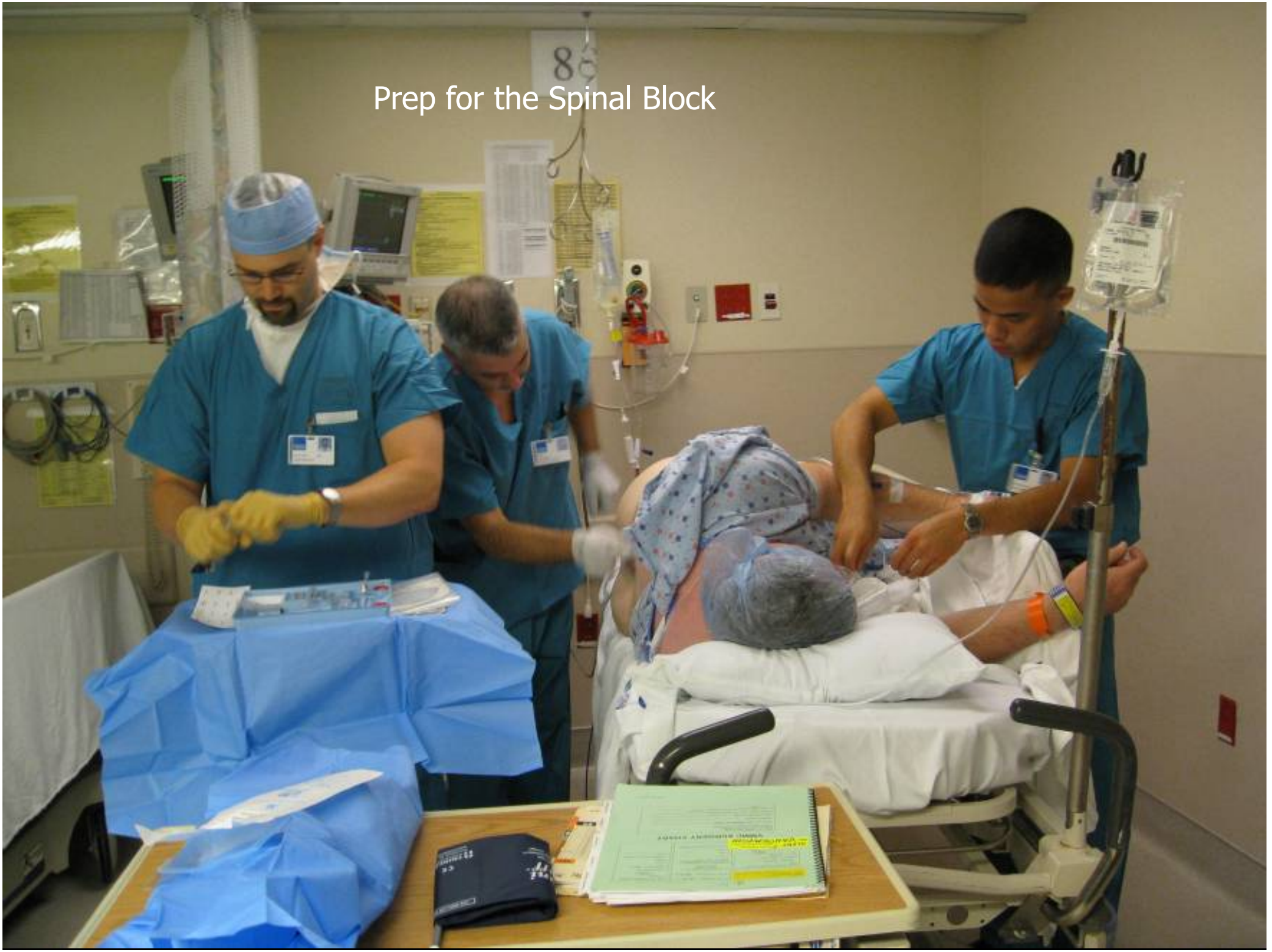
FNC Supply Needs
- Epidural Tray
- Sterile labels for PNB
- Sterile Gloves*
  - Resident (1)
  - Tech (1)
  - Attending (1)
- Ultrasound sleeve
- Tagaderm-large (2)
- Marking pen
- Local anesthetic

Spinal Block Supply Needs
- Spinal Block Tray
- Sterile labels for spinal
- Sterile Gloves*
  - Resident (1)
  - Tech (1)
- Local anesthetic

*=see size preference list on Anesthesia desk

The Standard Fem N Cath Setup:


The Femoral Nerve Cath


Prep for the Spinal Block


Spinal Block
STOLEN FROM PACU - 5th Floor

Addressing Pull: Cycle Time Analysis

Step 1: How Long Will This Case Take?

How long is the case going to take (cut to close time)?

Total Knee	☐	1 hr 20 min.
Total Hip	☐	1 hr 25 min.
Other (ask surgeon to estimate)	☐	_____ estimate

Does the surgeon expect any of the following?

Resident Involvement?	☐	_____ estimate
Anatomical Delays?	☐	_____ estimate
Uncemented Hip?	☐	15 min. less

Also factor in:

Room ready time before next patient	☒	25 min.

Total Minutes _____hr _____ min

Plus (+)

Incision Time _____:_____

Equals (=)

Estimated Room Ready Time _____:_____

Step 2: What Are The Next Patients Needs?

Patient Specific Issues (ask surgeon)

Diabetes	☐	5 min.
Limited mobility	☐	10 min.
Obesity (> 35 BMI)	☐	20 min.
Interpreter required	☐	10 min.

Required Induction Processing ☒ 40 minutes

Anesthesia Plan:

General or LMA	☐	0 min.
Spinal Block	☐	15 min.
Epidural	☐	25 min.
Femoral Nerve Cath.	☐	25 min.
Interscalene Block	☐	20 min.
Other:	☐	_____ estimate

Next Patient Prep Time _____ **hr** _____ **min**

Step 3: Calculate When to Call Out

Estimated Room Ready Time (from step 1) _____:_____

Minus (--)

Prep Time for Next Patient (from step 2) _____hr _____ min.

Equals (=)

Call Out Time _____:_____

Step 4: Set Countdown Reminder

Call Out Time (from step 3) _____:_____

Minus (--)

What Time is it Now? _____:_____

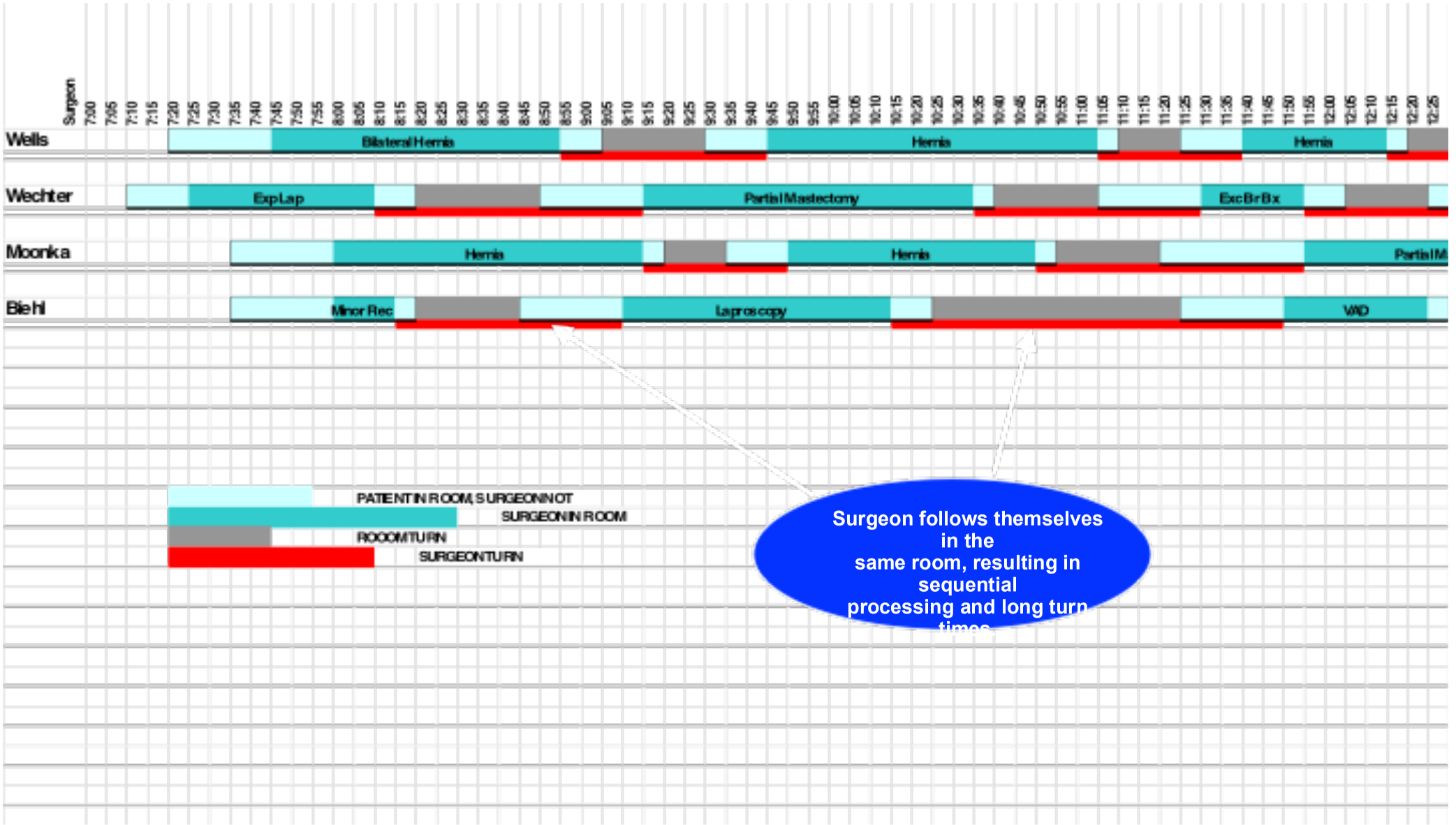
Equals (=)

Set Countdown Timer _____ min.

Key Points

- The Importance of Cycle Time Analysis
- External set-up
- Being ready to learn
- Make the Work Visual
- Staff involvement is Key
- Start Small and then Look for Opportunities to Generalize the Improvements

Addressing Flow: Current State Schedule



Production Pressure

OR Efficiency

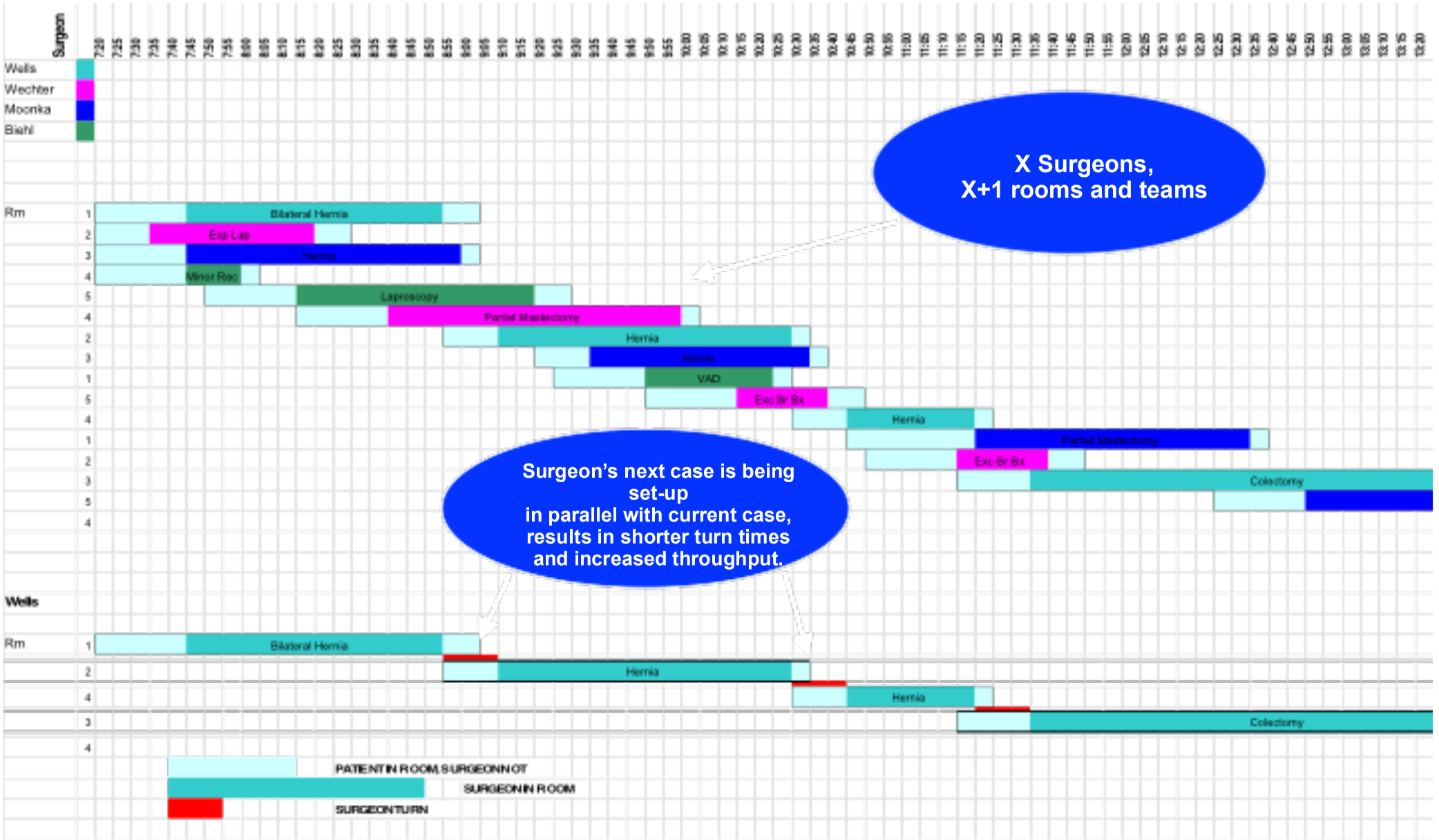
? Education

Conflict

Surgeon
Value-Added
Time

Anesthesia
Value-Added
Time

Future State=Cells



Results

- Surgeon Value Added Time (average)
  - Baseline: 68%
  - Cell Results: 90%
- Surgeon Turn Time (average)
  - Baseline: 66 min
  - Cell Results: 32 min
- Throughput Ratio (cases in OR hours)
  - Baseline: .49
  - Cell Results: .64

Next Steps

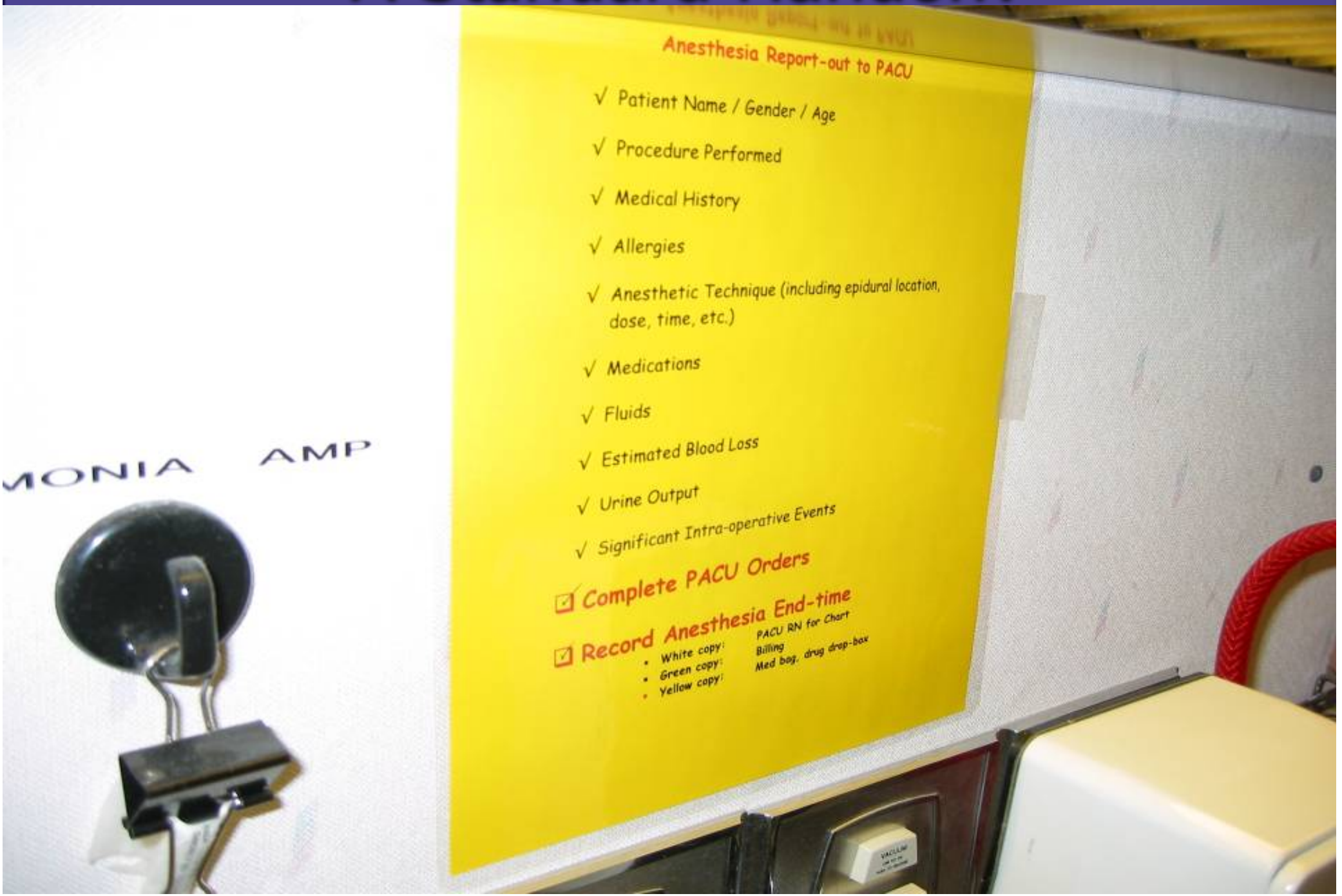
- Ensure good educational-value cases go to the right resident… and they're prepared
- Develop and implement standard work and communication standards (admit/induction, Anesthesia, nursing/tech team)
- Establish standard signals and Pull Production
- Predict and Prevent defects/delays

ZEROTASKING

OR Cells of the Future

- “Get the Clock off our Backs”
- Appropriate time for patient care
- Appropriate time for teaching
- Fewer “breaks” in the middle of cases
- Fewer hand-offs… fewer errors

A Standard Handoff:



“Without Standards, There Can Be No Improvement”

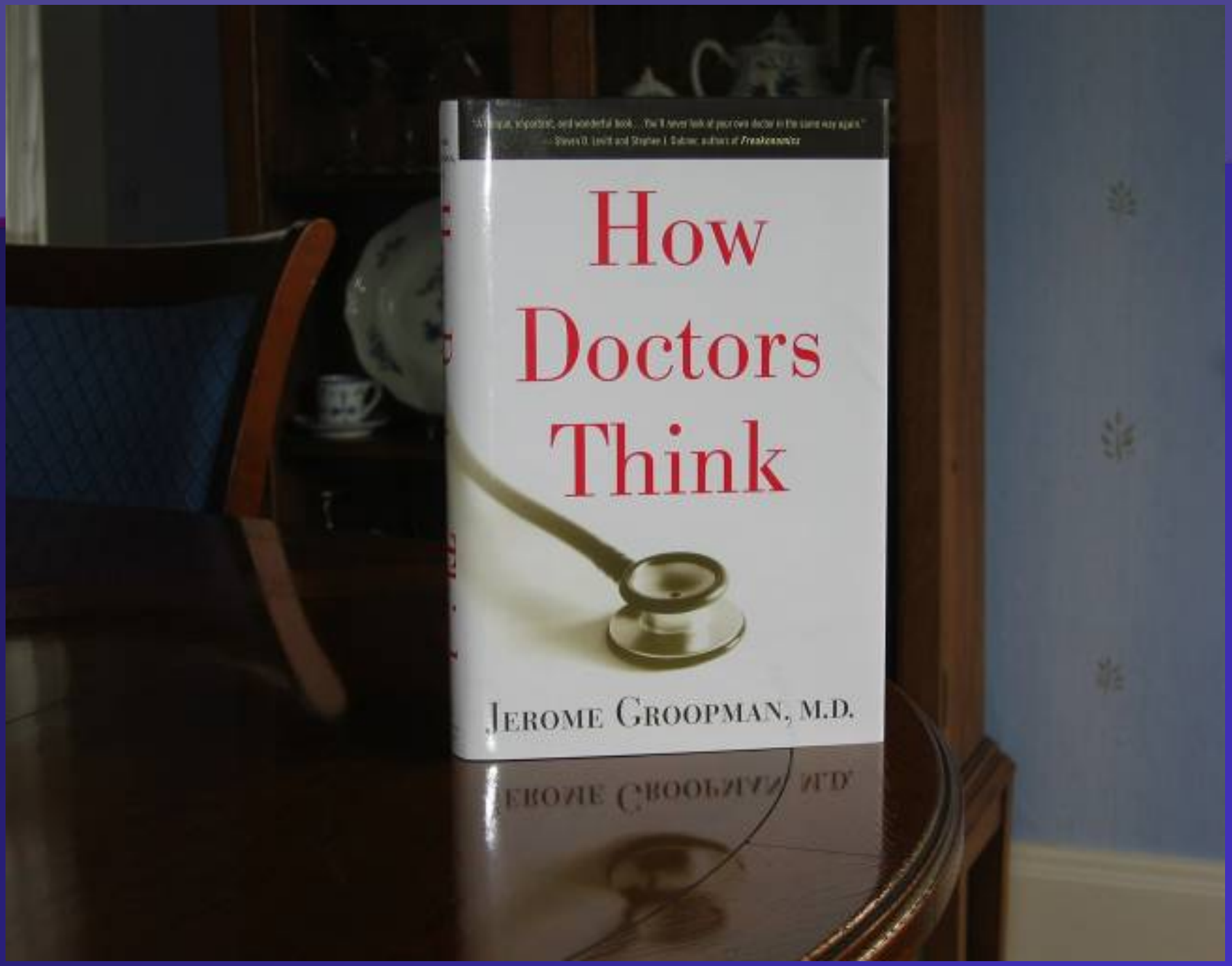
Taiichi Ohno

Standard Work

- Exact steps and sequence are determined
- Reduces variation
- Reduces defects
- Improves quality
- Allows template for improvement

The Problem with Standard Work:

- Doctors don't like it
- "no cookbook"
- "dumbing-down" medicine
- Issues with autonomy, control and the culture of medicine
- Lack of adherence to guidelines
- Lack of following evidence-based medicine


How
Doctors
Think
JEROME GROOPMAN, M.D.

Complex Environment

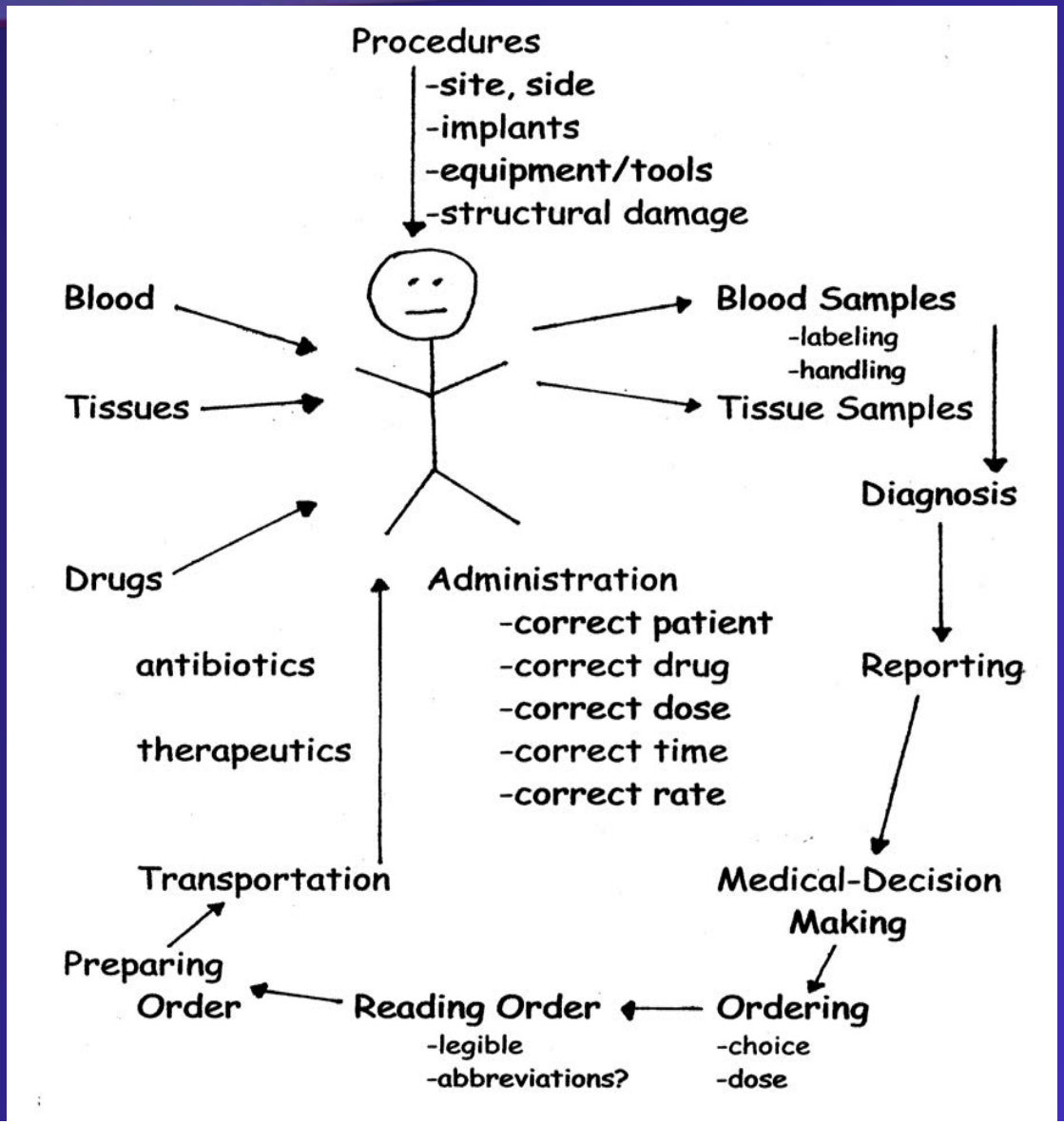
The American Board of Anesthesiology

- "A diplomate of the Board must possess knowledge, judgment, adaptability, clinical skills, technical facility and personal characteristics sufficient to carry out the entire scope of anesthesiology practice.
- An ABA diplomate must logically organize and effectively present rational diagnoses
- and appropriate treatment protocols to peers, patients, their families and others…"

Unfortunately, the ABA does not say:

- "The ABA diplomate must demonstrate the ability to work in and improve a system of care that will strive to reliably deliver the best evidence-based medical care to each patient, every time."

Explicit Training Needed in Touch Points of Care



New Paradigm of Teaching:

Medical Decision-Making

Standard Work on the Touch Points of Care

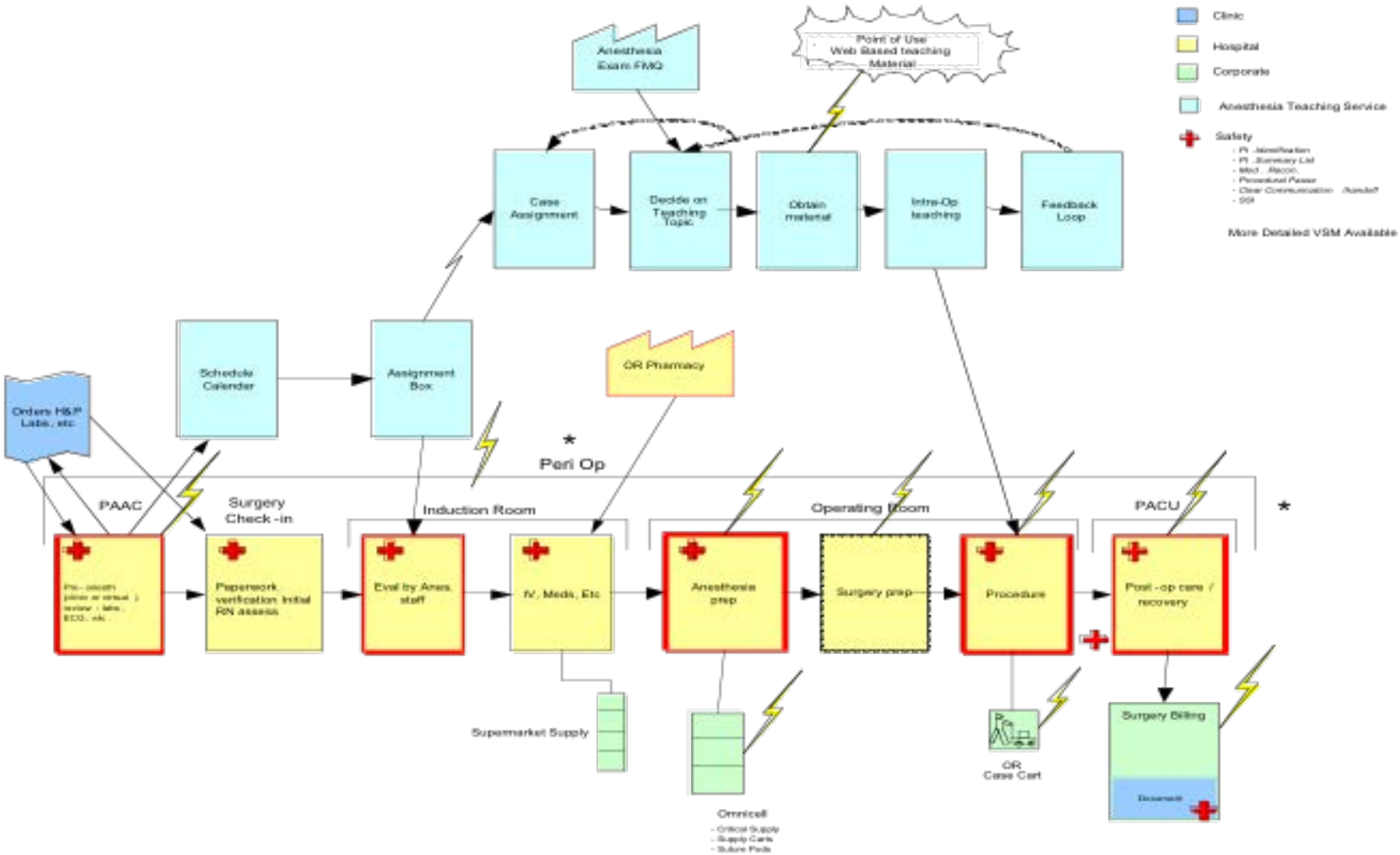
Migration to Explicit Training:

- **ACGME**: simulation; objective structured clinical examinations
- **ASA** National Meeting: central line complication prevention; demonstrated competencies prior to privileging; PFP
- **ASPF**: should training be mandatory prior to use of advanced medical equipment
- **Hospital Privileging Committees**
- **Institute for Healthcare Improvement**: Bundles of care

Acceptance and Training of Standard Work

The time has come…

SURGICAL SERVICES MODEL LINE VALUE STREAM MAP
Focus Area: Anesthesia Service DRAFT 10/23/06



2005 ABA/ASA In-Training Examination

Personal Performance Report

Name: [redacted]

ID Number: 35856688

Training Program Number: 154005

Your performance on the In-Training examination is reported as a scaled score. For more information about your In-Training examination score and to compare your performance with other residents, refer to the "Guidelines for Interpreting Your Personal Performance Report."

Your scaled score is: 27

Listed below is a keyword phrase for each test item you answered incorrectly and which at least half the AMG CA-3 group who were taking the examination for certification purposes for the first time answered correctly. A keyword phrase is a concise description of a fact or concept assessed by a test item. These phrases are categorized on the basis of similar content. The number of items contained in each content area is reported as part of the content area's title.

The keyword phrases are intended to help you plan your continuing medical education program by identifying subject matter within each content area you did not know.

Physiology (64 items)

Acute hepatic failure labs
Arterial waveform: reason for shape
Effect of gravity on respiratory physiology
Intraop hypothermia: mechanisms
Parasympathetic physiology
Spinal opiate receptors
Thoracic aneurysm repair: complications
Venous pressure: gravity effects
Acute renal impairment
Disease states: beta1 receptor density
Hypox pulm vasoconstriction
LV preload: best assessment techniques
Plot CO2 vs. minute volume
SSEPs: drugs increasing amplitude
Uterine blood flow

Pharmacology (44 items)

Acetylcholine nicotinic recept: activation
Blood/gas partition coefficient
Cyclophosphamide: anes implications
Droperidol: side effects
Inhaled anesth: metabolism
Local anesthetics: fetal toxicity
Nitroprusside toxicity
Prolonged paralysis with succ: diff Dx
Toxicity of local anesthetics
Toxicity of local anesthetics
Benzodiazepines: comparative pharm
Codeine-active metabolite
Dantrolene pharmacology
Flumazenil use
Isoflurane vs sevoflurane
Methemoglobinemia: Tx
Pharmacology of mannitol
Sympathetic nervous system transmitters
Toxicity of local anesthetics
Trace gases

Anatomy (12 items)

Ankle block: anatomy
Mediastinoscopy complications
Lower extremity block: anatomy
Needle and thoracostomy: complications

Continued on Next Page

Resident Participation in Lean Improvement projects is System-Based Learning

Systems-Based Practice… The ACGME:

- Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

Residents are expected to:

- understand how their patient care and other professional practices affect other health care professionals, the health care organization, and the larger society and how these elements of the system affect their own practice
- know how types of medical practice and delivery systems differ from one another, including methods of controlling health care costs and allocating resources

Residents are expected to:

- practice cost-effective health care and resource allocation that does not compromise quality of care
- advocate for quality patient care and assist patients in dealing with system complexities
- know how to partner with health care managers and health care providers to assess, coordinate, and improve health care and know how these activities can affect system performance

Before RPIW

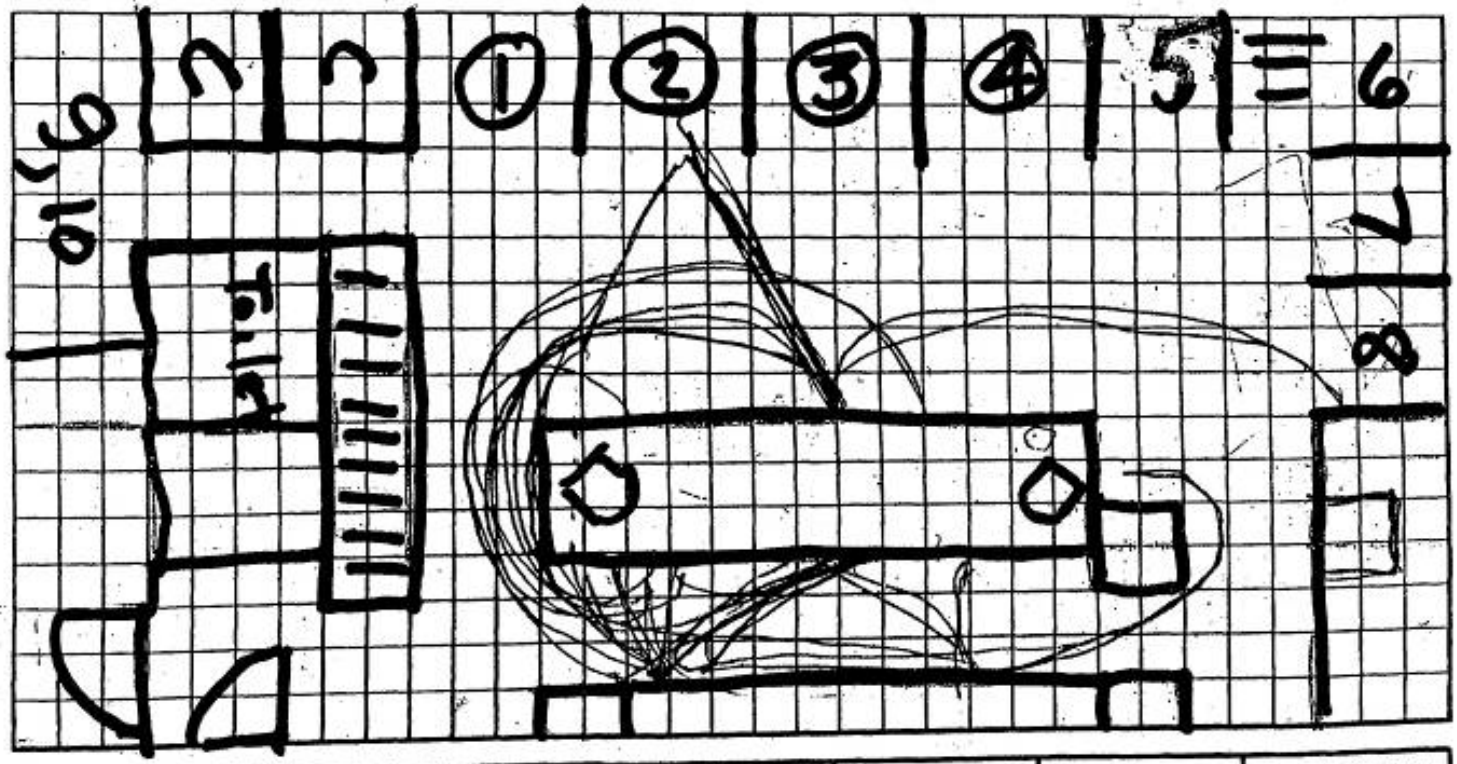
The Rapid Process Improvement Workshop

Standard Work Sheet

Process Name	Surgical Prep
Name	K Mossing

Process Boundaries	From PN work
	To with lot / Ltr

Date Prepared Or Revised	10/25/02



Quality Check	Safety Precaution	Standard WIP	# Pieces WIP	TAKT Time	Cycle Time	Operator Number
◇	✚					

After RPIW

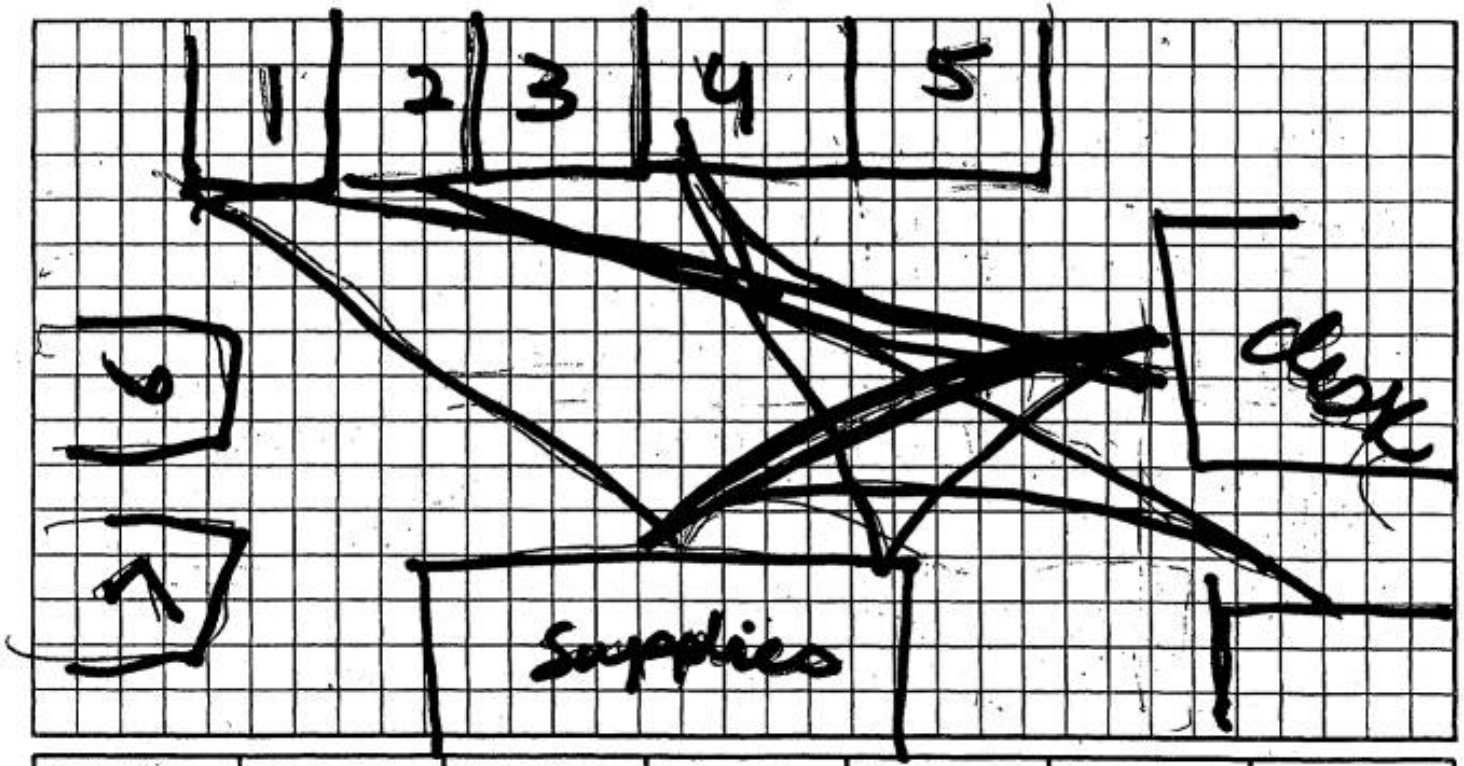
Value Stream Mapping

Standard Work Sheet

Process Name	RN-1
Name	

Process Boundaries	From IRN
	To LUR

Date Prepared Or Revised	4/7/02



Quality Check	Safety Precaution	Standard WIP	# Pieces WIP	TAKT Time	Cycle Time	Operator Number
◆	✚	●				


EXIT
4

Pre-op Clinical Assessment - Eligibility for Peri-op Beta Blockade Protocol

Step 1 - CHECK CURRENT USE OF BETA-BLOCKERS:

Is the patient already taking a beta-blocker for CV disease?	☐ YES, continue current beta-blocker, initiate protocol and proceed to O.R.	☐ NO

Step 2 - SCREEN FOR PRE-OPERATIVE CARDIAC RISK FACTORS:

Criteria for inclusion in peri-op beta blockade protocol: *If TWO or more of these risk factors chosen* ***and*** *NO CONTRAINDICATIONS then start Peri-op Beta Blockade Protocol*	☐ **High-risk surgical procedure**, as defined as: Thoracic, abdominal or pelvic vascular (e.g., aorta, renal, mesenteric) surgery ☐ **Ischemic heart disease**, as defined as: - History of myocardial infarction - History of or current angina - Use of sublingual nitroglycerin - Positive exercise test - Q waves on EKG - Patients who have undergone PTCA or CABG and who have chest pain (presumed to be of ischemic origin) ☐ **Heart failure**, defined as*: - Left ventricular failure by physical examination - History of paroxysmal nocturnal dyspnea - History of pulmonary edema - S3 or bilateral rales on physical examination - Pulmonary edema on chest x-ray ☐ **Cerebrovascular disease**, defined as: - History of transient ischemic attack - History of cerebrovascular accident ☐ **Insulin-dependent diabetes mellitus** ☐ **Chronic renal insufficiency**, defined as: - Baseline Creatinine ≥ 2.0 mg/dL

REVISED CARDIAC RISK INDEX (RCRI criteria) ***CIRCULATION*** *2006;113:1361-1376)*

Step 3 – ASSESS MEDICAL HISTORY:

Does the patient have a contraindication to beta-blockade?	
Absolute contraindications	☐ High-degree AV block (2^{nd} or 3^{rd} degree block or 1^{st} degree block with PR > .3) ☐ Uncompensated heart failure *(* use with caution & individualized)* ☐ Severe COPD (on chronic O2, steroids, unable to carry on usual ADL). ☐ Current use of amiodarone or sotalol.
Relative contraindications	☐ Patient on calcium channel blockers or digoxin ☐ Compensated CHF *(* use with caution & individualized)* ☐ Mild/moderately severe COPD or asthma ☐ History of diabetes with hypoglycemic episodes

Step 4 – PERI-OPERATIVE BETA-BLOCKADE PROTOCOL ORDER SHEET

☐ **See peri-op beta blockade order set – *ON BACK OF THIS FORM*** - patient meets 2 or more risk factors, is already on beta-blockade, and has no absolute / relative contraindications

☐ **DO NOT initiate peri-op beta blockade protocol –** patient does not meet two or more risk criteria, or has contraindications.

MD Signature:_____ Pager_____ Date/Time:_____

The Value of a Medical Education:

1. To be able to read, listen, understand and interpret the best evidence-based medicine available
2. To help create a delivery system to support #1… for every patient
3. To dedicate one-self to constant improvement of that system

Take-Home Messages:

- Good patient care is good teaching
- Hard-wire the educational experience into your processes
- Process improvement improves the educational experience
- Value, honor and serve the surgeon's needs
- We need more explicit training
- Process improvement is systems-based learning

Thank You!