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Brief Report

Implementation of an Un-Pairing Passport to Improve the Transition From Intern to Resident During a Critical Period of Anesthesiology Residency Training

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Introduction

The beginning of anesthesiology residency is a challenging time for trainees as they navigate patient care while acknowledging their knowledge deficits, budding procedural skills, and the unfamiliar perioperative environment. The volume and complexity of new critical knowledge, skills, and behaviors that must be rapidly acquired can be overwhelming.[1] After completing an intern year focused on fundamental clinical skills of medicine, anesthesiology residents focus their efforts onto mastering the perioperative management of patients on a steep learning curve.[2] This transition is not only difficult for new residents but also for those supervising and assessing their progress.

Although it is well-known that the transition from intern to anesthesiology resident is challenging, orientation methods vary widely between training programs. In a recent national survey of anesthesiology residency program directors, the duration of orientation and use of objective measures to determine readiness for the operating room and taking call was highly variable. Only 8 of the 56 responding programs used checklists or quizzes to assess transition efficacy. One program reported using an objective task-based passport during the orientation period that was required to be completed before taking call duties.[3]

Learning passports have been successfully implemented in other types of residency programs to assist with comparably difficult transitions in training. Emergency medicine residency programs have used passports to orient new interns to the department and as tools to prompt real-time feedback for learners.[4,5] Passports have also been used for pediatric intensive care unit rotations, which have shown improved resident satisfaction, better ability to identify knowledge gaps, and empowerment to ask directed questions of faculty.[6]

We developed an objective task-based un-pairing passport during the transition from intern to anesthesiology resident to serve as a roadmap for residents and their mentors and better tailor teaching and highlight expectations for new residents. The passport included skill and knowledge areas of focus, procedural requirements, feedback mechanisms, resources, and tips for success. It was required to be completed before un-pairing from a senior resident. The objective of this quality improvement project was to improve the overall preparedness of the new anesthesiology residents.

Methods

Passport Creation

The un-pairing passport was created for the San Antonio Uniformed Services Health Education Consortium Anesthesiology Residency Program in the spring of 2021 to be used during the summer of 2021 intern to CA-1 transition period. It was modeled after a similar passport tool used at the University of Florida Anesthesiology Residency Program. The interns were paired with a senior-level resident for a week at a time during the 6- to 8-week transition before starting their CA-1 year. They were required to complete the passport before "un-pairing" from a senior resident and being permitted to be staffed alone in the operating room with a staff anesthesiologist.

Passport Description

Seven key domains of knowledge, procedural skills, and feedback mechanisms were developed: Charting (Information Systems), Set-Up (Set-Up and Equipment), Pre-op (Preoperative Plan), Intra-op (Intraoperative Events), Post-op (Postoperative and Transition), Procedures, and When to Call Staff (Supplemental Online Material).

The Charting domain provides a framework for new residents as they transition from primarily using the inpatient charting functions to using the perioperative recordkeeping functions. The Set-Up domain requires the residents to demonstrate their knowledge and proficiency at preparing the operating room. They must show that they can perform required safety tests of various

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anesthesia machines, discuss and demonstrate the location and proper use of critical equipment, and prepare commonly used equipment and monitors for use.

The Pre-op domain emphasizes development and presentation of an anesthetic plan, justifying choices of medications, discussion of airway management techniques, planning for emergence and patient transport, and familiarity with relevant perioperative guidelines from the American Society of Anesthesiologists, American Society for Regional Anesthesia, and the American College of Cardiology/American Heart Association.

The remaining domains are intended to prepare the transitioning resident for intraoperative and postoperative crises and complication management, demonstrating basic proficiency with common procedures, and establishing familiarity with the nonclinical, academic, and administrative requirements for graduation from residency.

Study Design

We surveyed 3 groups (CA-1s, CA-2s/CA-3s [senior residents], and staff anesthesiologists) 6 months after the completion of passport implementation to retrospectively assess the 2021-2022 CA-1 class's preparedness across 7 domains compared with residents before passport implementation. Preparedness was ranked on a Likert scale from *1-not at all prepared* to *5-very prepared*. The preintervention surveys included 1 survey for senior residents regarding their personal preparedness at the beginning of their CA-1 year and 1 staff survey reflecting on previous CA-1 residents. Postintervention surveys included 1 survey for the 2021 CA-1 class and 1 staff survey to assess the CA-1 class in July 2021. Mann-Whitney *U* statistics and median effect sizes were used to compare pre- and postintervention.

Results

Twenty-one of the 27 senior residents completed the survey for a 78% response rate. Ten of the 14 CA-1s completed the survey for a 71% response rate. Twenty-eight of the 42 anesthesiologists surveyed completed the preintervention survey for a 67% response rate, and the response rate for the postintervention staff survey was 93% (39 of 42).

Self-reflected preparedness scores of the CA-1s were higher across all domains compared with the senior resident group (r = 0.328-0.548; Table 1). Overall level of comfort and preparedness for the start of CA-1 year was higher in the postintervention group (r = 0.162, 0.514; Table 1). Staff anesthesiologists' perceived preparedness of the residents was also higher across all domains for the postintervention group (r = 0.197-0.387; Table 2).

Discussion

The un-pairing passport provides residents and faculty with a tool to guide the transition between intern and CA-1 year. Before the passport, aside from a 1-week "bootcamp" introduction, there was no structured transition curriculum for our program. Important operating room tasks and procedures and familiarity with crisis management algorithms are now tracked via the passport. Previously, the assumption was that individual residents were being exposed to these critically important topics before working alone with staff in the operating room or taking call, but without a curriculum or structure in place to guarantee this, there was concern that many residents felt unprepared.

The reasons for improvement in self-assessed preparedness that we observed with the implementation of our passport are multifactorial. By integrating curriculum content and providing specific topics for both the residents and faculty to focus learning efforts on, faculty involvement and teaching in the operating room could be more focused.[7] Residents were able to engage with faculty with a guided learning tool and were better able to track gaps in their knowledge or key procedural skills, which has also been shown in other specialty residency programs that have used similar passport tools.[6]

Notably, we relied on teaching by both faculty and senior residents, as interns were paired with senior-level residents for up to 8 weeks while they completed the passport before they could be un-paired. Peer-assisted learning has been shown to be valuable to the development of junior residents, including their academic performance and especially for procedural skills in various residency programs.[8,9] Similar studies have yet to be done in anesthesiology training programs. Given that our residents were paired for a week at a time with a senior resident while the staff anesthesiologists varied daily, we believe consistent peer-assisted learning guided by the use of the passport improved the preparedness of our transitioning residents.

This quality improvement education initiative had its limitations. Responses were self-assessed ratings of preparedness and comfort level for all groups. There is potential for recall bias particularly with the preintervention surveys, as residents and staff alike were reflecting on experiences more than 1 year prior. We did not incorporate objective data or measures of performance, as our primary goal was to assess for resident preparedness for the daily behaviors, tasks, and knowledge of the operating room. Quizzes, exam scores, or evaluation of skills through an objective structured clinical examination scenario would provide additional data points to assess for readiness for residency. Biserial correlation and effect sizes were used for interpretation of survey data rather than *P* values of individual questions to measure significance. For quality improvement and curriculum development, the individual *P* values were of less importance to us, but rather we focused on the overall effect across groups of questions to assess preparedness more broadly. Furthermore, the small sample size of our residency program is a limitation despite acceptable response rates.

Future direction for our passport is already under way. We intend to continue to revise the passport based on resident feedback and to incorporate evolving anesthesia skills and requirements like adding point-of-care ultrasound skills. In addition, modified passports for introductory subspeciality rotations, including obstetric, pediatric, and cardiothoracic anesthesia, are now in circulation and being tested for efficacy. Variations of the passport would be translatable to any anesthesiology residency for this difficult transition in training as well as for the transition from residency to fellowship.

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Conclusion

Use of an un-pairing passport improved residents' and staff anesthesiologists' self-assessed preparedness of new CA-1 residents during a significant and difficult transition in training. This tool can be modified and applied to any anesthesiology residency program and to anesthesiology subspecialty training.

Acknowledgments

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Abstract

Background: The transition from intern year to the first year of clinical anesthesiology residency (CA-1) is a challenging period for residents and their supervisors. Orientation methods and instructional material targeting this transition vary across U.S. residency programs. An un-pairing passport was implemented during the 2021-2022 transition to guide and provide expectations for interns, senior residents, and staff. The objective of this quality improvement project was to assess the effectiveness of the passport in improving the transition period and overall preparedness of the new CA-1s.

Methods: We surveyed 3 groups (CA-1s, CA-2s/CA-3s, and staff anesthesiologists) 6 months after the completion of passport implementation to retrospectively assess the 2021-2022 CA-1 class's preparedness across 7 domains compared with those who transitioned before passport implementation. Mann-Whitney *U* statistics and median effect sizes were used to compare pre- and postintervention.

Results: Self-reflected preparedness scores of the CA-1s were higher across all domains compared with the senior resident group (r = 0.328-0.548). Overall level of comfort and preparedness for the start of the CA-1 year was higher in the postintervention group (r = 0.162- 0.514). Staff anesthesiologists' perceived preparedness of the residents was also higher across all domains for the postintervention group (r = 0.197-0.387).

Conclusion: The un-pairing passport improved residents' and staff anesthesiologists' subjective assessments of the readiness of new CA-1 residents after a critical transition in their training. Similar tools can be more broadly applied to other anesthesiology residency and possibly fellowship programs as well as subspecialty rotations within those programs.

Keywords: Perioperative medicine, residency milestones, curriculum

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Tables

Table 1. *Residents' Self-Assessed Preparedness Before and After Passport*

Key Domain	Senior Residents (Preintervention) Median Likert Score n = 21	2021 CA-1 Residents (Postintervention) Median Likert Score n = 10	Median Biserial Correlation (r)
Charting	2.5	4	0.431
Set-up	3	4	0.462
Pre-op	3	4	0.414
Intra-op	3	4	0.433
Post-op	3	4	0.491
Procedures	3	3.75	0.548
When to Call Staff	4	4	0.326
Level of comfort as an incoming CA-1 being the only resident assigned with a staff to a case	3	3.5	0.162
Level of preparedness as an incoming CA-1 to start the first day of CA-1 year	3	4	0.514

Abbreviation: CA-1, first-year clinical anesthesiology resident.

Table 2. *Staff Anesthesiologists' Perception of Resident Preparedness Before and After Passport*

Key Domain	Staff Preintervention Median Likert Score n = 28	Staff Postintervention Median Likert Score n = 39	Median Biserial Correlation (r)
Charting	3.25	4	0.197
Set-up	3.25	4	0.343
Pre-op	3	4	0.349
Intra-op	3	4	0.342
Post-op	3	4	0.367
Procedures	3	4	0.378
When to Call Staff	3.5	4	0.305

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Supplemental Online Material

CBY to CA1 Survey Questions

Please rate your level of preparedness as an incoming CA1 (July 2021) as it pertains to the following questions:
(1 - Not at all prepared, 2 - Not prepared, 3 - Neutral, 4 - Prepared, 5 - Very prepared)

Charting

1. Perform a thorough preoperative evaluation and document in Essentris.
2. Find essential information in AHLTA, Epiphany, and JLV.
3. Document intraoperative events in Innovian, including blood product administration.
4. Put in a 518 for ordering blood products on a patient not previously type & screened.

Set-Up

5. Perform a complete machine check on a Drager Fabius.
6. Perform a complete machine check on a Drager Apollo.
7. Perform a complete machine check on a Drager Perseus.
8. Locate the difficult airway cart and MH cart on both the COTO and Main side.
9. Set up the OR for a case independently.
10. Set up a hotline and arterial line independently.

Pre-Op Plan

11. Perform an airway exam.
12. Describe common induction medications, doses and indications.
13. Discuss indications and procedure for RSI.
14. Discuss indications for LMA vs ETT.
15. Discuss extubation criteria.
16. Develop an anesthetic plan on an ASA 3 patient.
17. Present an anesthetic plan cohesively and succinctly to an attending.
18. Discuss ACC/AHA Guidelines for patients undergoing non-cardiac surgery.
19. Discuss ASRA anticoagulation guidelines for regional and neuraxial anesthesia.
20. Discuss the ASA Difficult Airway Algorithm and the Vortex Approach.

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Supplemental Online Material *continued*

Intra-Op Events

21. Describe a differential for hypoxia.
22. Describe a differential for hypotension.
23. Describe a differential for increased airway pressures.
24. Manage and temporize hypoxia until help arrives.
25. Manage and temporize hypotension until help arrives.
26. Manage and temporize increased airway pressures until help arrives.
27. Describe and manage laryngospasm.
28. Discuss common vasoactive medications, mechanisms of action, doses and indications for use.

Post-Op & Transitions in Care

29. Handoff to PACU or ICU using SEAMLESS template.
30. Describe a differential for and management of PONV.
31. Describe a differential for and management of hypertension.
32. Describe a differential for and management of hypopnea/apnea.
33. Describe a differential for and management of delayed emergence.

Procedures

34. Place an 18g PIV.
35. Place an ultrasound guided arterial line.
36. Effectively mask ventilate.
37. Perform smooth direct laryngoscopy and intubation.
38. Program an alaris pump for a remifentanil infusion.
39. Program an epidural pump for a ropivacaine infusion.

When to Call Staff

40. Identify hemodynamic changes requiring a call to staff.
41. Identify positioning changes requiring a call to staff.
42. Identify airway/ventilator changes requiring a call to staff.
43. Identify critical events in a case requiring a call to staff.

Additional Questions

44. Feel comfortable being the only resident assigned with a staff to an OR case.
45. Feel prepared to start the first day of CA1 year.
46. Were you a field applicant?
47. Did you complete the passport before arriving to SAMMC?

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Supplemental Online Material *continued*

Staff Survey Questions

Please rate your perception of the preparedness of the new CA1 class in July 2021 as it pertains to the following questions:

(1 - Not at all prepared, 2 - Not prepared, 3 - Neutral, 4 - Prepared, 5 - Very prepared)

Please rate your perception of the preparedness of PREVIOUS CA1 classes in July of their CA1 year as it pertains to the following questions:

(1 - Not at all prepared, 2 - Not prepared, 3 - Neutral, 4 - Prepared, 5 - Very prepared)

Charting

1. Perform a thorough preoperative evaluation and document in Essentris.
2. Find essential information in AHLTA, Epiphany, and JLV.
3. Document intraoperative events in Innovian, including blood product administration.
4. Put in a 518 for ordering blood products on a patient not previously type & screened.

Set-Up

5. Perform a complete machine check on a Drager Fabius.
6. Perform a complete machine check on a Drager Apollo.
7. Perform a complete machine check on a Drager Perseus.
8. Locate the difficult airway cart and MH cart on both the COTO and Main side.
9. Set up the OR for a case independently.
10. Set up a hotline and arterial line independently.

Pre-Op Plan

11. Perform an airway exam.
12. Describe common induction medications, doses and indications.
13. Discuss indications and procedure for RSI.
14. Discuss indications for LMA vs ETT.
15. Discuss extubation criteria.
16. Develop an anesthetic plan on an ASA 3 patient.
17. Present an anesthetic plan cohesively and succinctly to an attending.
18. Discuss ACC/AHA Guidelines for patients undergoing non-cardiac surgery.
19. Discuss ASRA anticoagulation guidelines for regional and neuraxial anesthesia.
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Supplemental Online Material *continued*

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28. Discuss common vasoactive medications, mechanisms of action, doses and indications for use.

Post-Op & Transitions in Care

29. Handoff to PACU or ICU using SEAMLESS template.
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42. Identify airway/ventilator changes requiring a call to staff.
43. Identify critical events in a case requiring a call to staff.

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Supplemental Online Material *continued*

Current Resident Survey Questions

To the best of your ability, please rate your PERSONAL level of preparedness at the beginning of your CA1 year for the following questions:
(1 - Not at all prepared, 2 - Not prepared, 3 - Neutral, 4 - Prepared, 5 - Very prepared)

Please rate your perception of the preparedness of the current CA1 class (in July 2021) as it pertains to the following questions:
(1 - Not at all prepared, 2 - Not prepared, 3 - Neutral, 4 - Prepared, 5 - Very prepared)

Charting

1. Perform a thorough preoperative evaluation and document in Essentris.
2. Find essential information in AHLTA, Epiphany, and JLV.
3. Document intraoperative events in Innovian, including blood product administration.
4. Put in a 518 for ordering blood products on a patient not previously type & screened.

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Pre-Op Plan

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18. Discuss ACC/AHA Guidelines for patients undergoing non-cardiac surgery.
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Supplemental Online Material *continued*

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42. Identify airway/ventilator changes requiring a call to staff.
43. Identify critical events in a case requiring a call to staff.

Additional Questions

44. Feel comfortable being the only resident assigned with a staff and OR case.
45. Feel prepared to start the first day of CA1.
46. What is your current class year?
47. Were you a field applicant?

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Supplemental Online Material *continued*

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Supplemental Online Material *continued*

Information Systems

- ☐ Demonstrate proficiency with the following programs:
  - ☐ Essentris
  - ☐ AHLTA
  - ☐ CHC
  - ☐ JLV/HAIMS
  - ☐ Epiphany
  - ☐S3
  - ☐IMPAX
  - ☐iMEDConsent
  - ☐Innovian
- ☐ Demonstrate knowledge + timeliness of anesthesia specific notes in Essentris
  - ☐ANES PreAnesthesia Eval/(Re)Eval—Prior to every trip to OR, Updated on DOS
  - ☐ANES Post Anesth Instructions—Prior to PACU discharge
  - ☐ANES Post Anesthesia Eval—Within 48 hrs
  - ☐ANES Pain Note--Daily
  - ☐ANES Procedure Note—date of procedure
  - ☐ANES Intraop Record—DOS
  - ☐ANES Transfer of Care Note—DOS (ICU)
- ☐ Demonstrate ability to use anesthesia specific order sets, (PACU, Peds PACU, CPNB, etc)
- ☐ Demonstrate ability to order blood and check products prior to administration

Set-Up and Equipment (items may be initialed by anesthesia tech)

- ☐ Demonstrate a thorough machine checkout, including high-pressure and low-pressure check, vacuum adjustment, etc.
- ☐ Discuss “must-have” equipment, BVM, O2 supply, suction, bougie etc.
- ☐ Demonstrate ability to set up and use the following:
  - ☐ IV set-up including secondary set
  - ☐ ETCO2 for MAC cases
  - ☐ Arterial line and transducer
  - ☐ Hot-line
  - ☐ BELMONT
  - ☐ Blood/platelet tubing
  - ☐ Glidescope (Video laryngoscopes)
  - ☐ Bronchoscopy Tower
  - ☐ BIS Monitor
- ☐ Demonstrate knowledge of code cart, MH Cart, Fire Extinguishers and Difficult airway cart locations on COTO and MAIN sides.
- ☐ Demonstrate familiarity with OR 18 and equipment/set-up.
- ☐ Set up the OR for a case independently

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Supplemental Online Material *continued*

Pre-operative Plan

- ☐ Appropriately present a case, and develop anesthetic plan to pairee and attending. (5 with senior resident present)
- ☐ Be able to discuss "ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Non-cardiac Surgery"
- ☐ Be able to discuss ASRA guidelines and absolute vs relative contraindications for neuraxial and regional anesthesia (Consider purchasing ASRA app suite)
- ☐ Describe induction including:
  - Pre-medications (list)
  - Position
  - Drugs and doses: list and rationale
  - Indications and procedure for RSI
- ☐ Demonstrate ability to perform airway exam
- ☐ List predictors of difficult intubation and difficult mask ventilation
- ☐ Diagram out ASA Difficult Airway Algorithm and the Vortex Approach to Airway Management
- ☐ Be able to discuss when a patient is appropriate for an LMA or an ETT.
- ☐ Discuss management of patient for a MAC procedure including:
  - Potential IV sedation agents
  - Monitoring requirements
  - Describe Mild, Moderate, and Deep Sedation, and Monitored Anesthesia Care
- ☐ Be able to discuss maintenance phase including:
  - <u>Volatile agents:</u>
    - Most important characteristics/contraindications
    - MAC/blood gas partition coefficient/vapor pressure
  - <u>Muscle relaxant choices and doses:</u>
    - Most important characteristics/contraindications
  - <u>Opioid choices and doses:</u>
    - Most important characteristics/contraindications for common ones (Fentanyl, Hydromorphone, Remifentanil, Morphine)
  - <u>PONV Prevention</u>
  - <u>TIVA</u>
- ☐ Be able to discuss emergence phase including:
  - Extubation Criteria
  - When to D/C Volatile agent or TIVA
  - Neuromuscular Blockade reversal (drugs/doses)
  - Common side effects of reversal

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Supplemental Online Material *continued*

Intraoperative Events (OR or Simulation)

- ☐ Describe differential and immediate actions for the following:
  - ☐ Hypoxia
  - ☐ Increased airway pressures
  - ☐ Hypertension
  - ☐ Hypotension
  - ☐ Hypothermia
  - ☐ Hyperthermia
  - ☐ Hypocapnea
  - ☐ Hypercapnea
- ☐ Describe indications/dose/mechanisms for common pressors/inotropes/antihypertensives:
  - ☐ Phenylephrine
  - ☐ Ephedrine
  - ☐ Vasopressin
  - ☐ Epinephrine
  - ☐ Norepinephrine
  - ☐ Labetalol
  - ☐ Esmolol
- ☐ Describe transfusion criteria
- ☐ Calculate Maximum Allowable Blood Loss (MABL)
- ☐ Describe prevention and management of laryngospasm
- ☐ Describe MH management
- ☐ Describe airway fire management
- ☐ Describe OR vs PACU Code blue protocols
- ☐ Describe OR fire protocols
- ☐ Describe actions if power fails in OR
- ☐ Review criteria for notifying staff
- ☐ Demonstrate appropriate interaction with OR nurses and techs

Post-op and Transition (OR or Simulation)

- ☐ Demonstrate appropriate handoff in PACU and ICU using SEAMLESS template
- ☐ Demonstrate how to use the Aldrete score.
- ☐ Demonstrate ability to write an anesthesia postop note
- ☐ Discuss management of the following post-operative crises:
  - ☐ Hyper/Hypotension
  - ☐ Hypoxia
  - ☐ Pain
  - ☐ Delayed emergence/Delirium/Weakness
  - ☐ Nausea/Vomiting
  - ☐ Apnea/Hypopnea
  - ☐ Brady/Tachyarrythmias
- ☐ Demonstrate appropriate interaction with PACU/ICU nurses

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Supplemental Online Material *continued*

Procedures

- ☐ >10 Successful peripheral IV observed
- ☐ >10 Satisfactory Mask Ventilations
- ☐ >10 smooth DL intubations observed (2 with bougie)
- ☐ > 5 smooth Glidescope intubations observed (2 with bougie)
- ☐ >5 smooth LMA placements
- ☐ Ultrasound—Obtain image and ID anatomy:
  - ☐ IJ x3
  - ☐ Radial Artery x3
  - ☐ Femoral vessels x3
  - ☐ Cardiac/Lung POCUS exams x3
- ☐ Observe or perform 3 A-line insertions
- ☐ Observe or perform 3 peripheral nerve blocks
- ☐ Program Alaris pump for infusion x10
- ☐ Program Epidural/CPNB pump for infusion x10

IV										
MV										
DL										

Glide					

LMA					

IJ			
Radial			
Femoral			
Chest			

A-line			
Block			

Alaris Pump										
Epi/CPNB Pump										

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Supplemental Online Material *continued*

Moving Forward

- ☐ Create Personal Study Plan
- ☐ Set Goals (ie # of publications, ITE score, chief resident, PT scores, fellowships etc)
- ☐ Meet with a Chief Resident 1 on 1 to discuss expectations as a CA1 and review Personal Study Plan
- ☐ Meet with respective service APD to discuss the following:
  - ☐ Personal Study Plan
  - ☐ Goals
  - ☐ SAUSHEC Policies (Days away, leave, supervision, etc)
  - ☐ Service specific duties and obligations
- ☐ Meet with QIPS APD (Dr. McElrath) to review and acknowledge QI/PS policy
- ☐ Meet with Research APD (Dr. Patzkowski) to review and acknowledge research policy

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Supplemental Online Material *continued*

When to call your staff

This list is not inclusive. Its purpose is to facilitate communication between the provider and the attending staff, increase awareness and decrease intraoperative complications. Please call your attending at any point when you feel it is appropriate. Discussion with attending overrides any issue below.

IT IS ALWAYS OK TO CALL YOUR STAFF.
IT IS NOT A SIGN OF WEAKNESS.

1) **Changes or disparity in surgical and/or anesthetic plan**
2) Prior to initiation of **anesthetic induction**
3) **Critical events** during the surgery
   a) positioning (prone, ¾ prone, lithotomy, etc)
   b) repositioning or unexpected patient movement, prolonged period with limb unsupported
   c) microscope in/out of the field, head pinning, tracheostomy placement, aortic cross clamp on/off, rewarming coming off bypass, single lung ventilation, aneurysm clipping or any other critical portion of the surgery
4) Important laboratory parameters or **any "critical" value**:
   a) **Lactate** > 2.5 mmol/L
   b) **Hct** ≤ 24, Hb ≤ 8.0
   c) **BE** < -3
5) **Hemodynamic instability** that would require:
   a) Need for frequent vasopressors for blood pressure support
      i) e.g. > 200 mcg phenylephrine or 25 mg ephedrine or 2 U vasopressin over 15 min period
      ii) when a total of 10 mg phenylephrine or 2 U vasopressin has been exceeded
   b) Initiation of a vasoactive infusion
   c) Cardioversion or defibrillation
   d) **Crystalloid administration** of > 20 ml/kg/hr
6) Vital sign abnormalities
   a) Core **temperature**: < 35°C or > 38°C
   b) Unanticipated **SpO_2**: < 90%
   c) **EKG** changes (ST segment change from baseline, sustained tachy/bradycardia or arrhythmias)

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Supplemental Online Material *continued*

d) **FiO_2**: Unexpected increase in requirement
e) **$EtCO_2$**: Unexpected changes in values or waveform
f) **SBP:** < 30% baseline for > 10min or MAP < 60
g) **HR**: > 100 or < 50 bpm in adults
h) **Urine output**: < 0.5 ml/kg/hr or > 5 ml/kg/hr (absence of mannitol)
i) **BIS** consistently > 60 (paralyzed patient)

7) **PIP** > 30 cm H_2O unless insufflation of the abdomen is present, then PIP > 40 cm H_2O
8) **EBL** greater than 5ml/kg or a preset number determined specifically for the patient, decision or consideration of **blood transfusion** not previously discussed with the attending, **coagulation issues**
9) **Airway**
   a) unexpected change in peak airway pressure
   b) dislodgement, wheezing
10) Suspected adverse **medication** or **transfusion reaction** (rash, hypotension, fever, red urine)
11) **Machine fault**
12) **Procedures** (e.g. a-line, CVL, TEE, etc)
13) 10-15 min **anticipation of end of surgery**: (attending surgeon breaking scrub)
14) Any knowledge of a **medical error** (e.g. unintended laceration, abrasion, wrong side block etc. ANYTHING)
15) **A concerning environment**
16) **IMPORTANT PHONE NUMBERS**
   a) **916-6705:** Anesthesia board runner (AFC)
   b) **916-9100:** VOCERA. Call from badge or phone. CALL AFC, CALL LHC, CALL PACU ANESTHESIA. BROADCAST ANESTHESIA "HELP TO OR #__." CALL BLOOD BANK