5-31-2017

Preventing Isolated Perioperative Reintubation: Who is at highest risk?

Tyler M. Bauer, MD
Thomas Jefferson University

Adam P. Johnson, MD
Thomas Jefferson University

Chris Wirtalla, MD
University of Pennsylvania

Jordan E. Goldhammer, MD
Thomas Jefferson University

Rachel R. Kelz, MD
University of Pennsylvania

Authors

Tyler M. Bauer, MD; Adam P. Johnson, MD; Chris Wirtalla, MD; Jordan E. Goldhammer, MD; Rachel R. Kelz, MD; and Scott W. Cowan, MD

Preventing Isolated Perioperative Reintubation: Who is at highest risk?

Tyler M. Bauer[1], Adam P. Johnson[1], Chris Wirtalla[2], Jordan E. Goldhammer[3], Rachel R. Kelz[2], and Scott W. Cowan[1]

[1]Department of Surgery, Thomas Jefferson University Hospital; [2]Department of Surgery, University of Pennsylvania; [3]Department of Anesthesia, Thomas Jefferson University Hospital

Background

- Postoperative respiratory complications occur in 1.03% of surgery patients with an average costs of $62,704 per patient, per event.[1,2]
- Post-operative respiratory failure is often secondary to a concurrent severe complication, such as cardiac arrest, sepsis, pneumonia, aspiration, or pulmonary embolism.[3]
- Isolated perioperative reintubation (IPR), defined as unplanned intubation in the first 24 hours of surgery without concurrent complications, has not been well characterized in the literature.
- IPR likely occurs due to one or a combination of the following[3,4]:
    - Opioid overdose
    - Over-sedation
    - Residual paralysis
    - Fluid overload.
- IPR represents a rare but possibly preventable cause for respiratory failure in the immediate postoperative period.

Objectives

1. We aim to characterize IPR nationally through a retrospective review of the National Surgical Quality Improvement Program participant user file (NSQIP PUF).
2. Identify risk factors for IPR including analysis of procedure type and preoperative characteristics.

Methods

- The 2014 NSQIP PUF was queried for all observations.
- Study and event exclusions were applied as below (Figure 1A and B)
- Procedures were grouped by Current procedural terminology (CPT) code, as recommended in the NSQIP appendix B file.
- IPR was analyzed with known risk factors and procedure grouping using chi square analysis ($p < 0.001$)
- Multivariable logistic regression Analysis was used to analyze for independent risk factors ($p < 0.05$)
    - Inclusion into the multivariable analysis was based on a chi square p value < 0.1.

Figure 1A: Study Exclusions

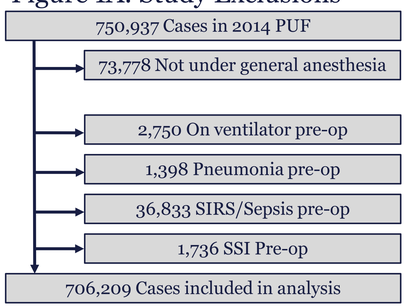
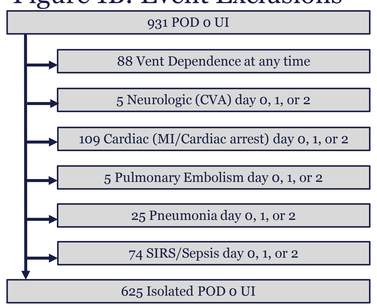


Figure 1B: Event Exclusions



Results

- Chi-squared analysis identified 22 patient covariates and 18 CPT procedure groups that were associated with IPR ($p<0.1$) and included in the multivariable analysis.
- Multivariable logistic regression analysis identified 12 patient factors and 8 operation types significantly associated with an elevated likelihood of IPR ($p<0.05$).

IPR Covariate	OR	P>|z|	95% CI
Preoperative risk factor			
Age (>60 years)	1.44	<0.001	1.2 - 1.72
Current smoker	1.25	0.023	1.03 - 1.51
Report of dyspnea (rest and moderate)	1.76	<0.001	1.41 - 2.19
Ascites (in prev 30days)	2.22	0.039	1.04 - 4.74
COPD (Severe)	1.88	<0.001	1.49 - 2.37
CHF(in prev 30 days)	1.89	0.002	1.27 - 2.81
HTN	1.44	<0.001	1.19 - 1.75
Transfusion preoperatively in last 72 hours	2.87	<0.001	1.94 - 4.26
Wound classification (>/= 2)	1.32	0.007	1.08 - 1.62
ASA classification (>/= 3)	3.10	<0.001	2.44 - 3.93
Operative time (>3 hours)	1.65	<0.001	1.38 - 1.99
African American	1.34	0.013	1.06 - 1.7
Procedure			
Colectomy	1.45	0.009	1.1 - 1.92
Esophagectomy	3.79	<0.001	1.95 - 7.36
CAS	7.92	0.041	1.08 - 57.89
EVAR	2.37	<0.001	1.5 - 3.73
Aorticoilliac (open)	2.36	0.001	1.4 - 3.98
Spine	0.62	0.046	0.39 - 0.99
Nephrectomy	1.74	0.026	1.07 - 2.84
Cystectomy	2.07	0.039	1.04 - 4.12
TKA	0.31	0.010	0.13 - 0.75
Hip Fracture	1.79	0.020	1.1 - 2.93

Discussion

- We identified a national IPR of 0.1% in all eligible patients.
- Ten procedures demonstrate a higher than average likelihood of IPR, and two, spine and knee arthroplasty, demonstrate a lower likelihood.
    - TKA and Spine Surgeries had a odds ratio of < 0.01 (protective). We believe this was due to a low amount of onboard anesthetics and enhanced operative management of anesthesia with somatosensory evoked potentials respectively.
- Further chart review and prospective analysis may be required to understand the mechanism for increased likelihood of IPR in other general and vascular procedures.
- Many of the patient comorbidities overlap with risk factors for

Limitations

- Retrospective review of registry data is limited to data collected by the registry and may not have generalizability outside of participants in the ACS NSQIP patient registry.
- Since there is no explicit variable for IPR, it was inferred by exclusions. Further chart review at an institutional level may be necessary to validate the application of the se exclusions for this purpose.

Next Steps

- Perform institutional review of IPR events and compare to national trends and benchmarks. This will allow us to better understand:
    - Interplay and overlap of underlying etiologies.
    - Cost an average IPR event.
- Combining the identified risk factors with physiologic parameters during emergence from anesthesia to help develop a high risk pulmonary pathway in the immediate perioperative period.
    - Traditionally, neostigmine has been used to promote anesthesia reversal in high risk patients
    - New, novel neuromuscular blockade reversal agents have demonstrated more effective at reversing the neuromuscular blockade than neostigmine, albeit at a higher price.
    - As the price for neostigmine rises, and becomes more comparable to these new agents, it may become beneficial to treat high risk groups, such as the ones identified in our study, with the newer agents.
- Develop and validate robust anesthesia and surgery outcomes.
    - Many outcomes require appropriate patient selection, pre-operative optimization, and intra-operative management by anesthesia.
    - Outcomes such as IPR require close coordination and collaboration between anesthesia and surgery.
    - Sharing and benchmarking outcomes like these may help to promote collaboration for improved outcomes in these two specialties

References

1. Dimick JB, Chen SL, Taheri P a, et al. Hospital costs associated with surgical complications: a report from the private-sector National Surgical Quality Improvement Program. *J. Am. Coll. Surg.* 2004;199:531–7. doi:10.1016/j.jamcollsurg.2004.05.276.

2. Alvarez MP, Samayoa-Mendez AX, Naglak MC, et al. Risk Factors for Postoperative Unplanned Intubation: Analysis of a National Database. *Am. Surg.* 2015;81:820–825.

3. Milgrom DP, Njoku VC, Fecher AM, et al. Unplanned intubation: when and why does this deadly complication occur? *Surgery* 2013;154:376–83. doi:10.1016/j.surg.2013.05.006.

4. Craft J. Patient-controlled analgesia: Is it worth the painful prescribing process? *Proc. Bayl. Univ. Med. Cent.* 2010;23:434–438.