Neuromuscular blocking agents (NMBA) can leave multiple lasting effects on a patient’s post-anesthesia outcomes. Residual block can lead to respiratory muscle weakness that may lead to aspiration, pneumonia, and even reintubation. In addition, it can lead to a subjective sensation of fatigue. Fortunately, depth of blockade can be monitored to better assure the patient’s safety. One method is train-of-four (TOF) monitoring which can be utilized multiple times throughout the neuromuscular block to provide important information regarding the depth of the block. Additional information can be obtained from a TOF ratio, the ratio of twitch four (T4) to twitch one (T1) height using acceleromyography (EMG). A TOF ratio greater than 0.9 is associated with an acceptable level of recovery to reduce adverse post-anesthesia muscle weakness (1,2).

A Quality Improvement initiative was started at this quaternary care center involving charting TOF, charting reversal of blockade, and reviewing post-anesthesia reintubation rates. Beginning the Plan-Do-Check-Act cycle, it is intended to decrease the rates of post-anesthesia reintubation, improve TOF charting compliance, improve TOF ratio use, and improve appropriate blockade reversal. Eligibility included adults eighteen years and older that had received general anesthesia with endotracheal tube placement and either vecuronium, rocuronium, cisatracurium, or atracurium in the inpatient operating room from March 1st, 2017-March 28th, 2017. Exclusion criteria included all cardiac surgery, pediatric patients, patients left intubated, and ASA class 5 or 6. Parameters evaluated included: 1. TOF charted prior to reversal, 2. TOF ratio charted, 3. if no reversal then was TOF ratio > 0.9, 4. if no reversal or TOF ratio > 0.9 then was it more than 3 hours since last NMBA dose, and 5. reintubation within two hours postoperatively.

This initial four-week data collection showed a few notable behaviors in this department regarding neuromuscular blockade. Charting TOF compliance was lower than expected at 81.78% and TOF ratio use was 21.38%. Failure to give patients reversal without charting return of neuromuscular function was 3.90%. Given these findings, we worked in an interdisciplinary team with pharmacy, information technology, and multiple anesthesia providers (faculty, resident, CRNA, AA, medical students) to design updates in the EPIC electronic health record (EHR). Pop-up reminders were implemented to prompt providers to monitor TOF during the case after any non-depolarizing blockade agent was given, and then to chart reversal given. Data was again collected between June 26th, 2017 and July 23rd, 2017. Comparison between groups in the parameters listed above revealed TOF charting compliance increase from 81.78% to 87.08%. There was also a decrease in reintubations due to respiratory muscle weakness from residual neuromuscular blockade from one to zero between groups. TOF ratio use continued to be poor, however this was likely due to engineering issues with monitor compatibility issues that are being investigated.
Due to the brief period of data collected pre- and post-intervention, it is worthwhile for additional data collection over a longer period of time to assess any statistical significance to our findings, but the trend is encouraging. It is intended to continue these "pop-up reminders" in the EHR. Future iterations of the PDCA cycle could include developing additional reminders in EPIC to providers to give appropriate doses of neostigmine and sugammadex based on TOF and TOF ratio based on current literature (3). As this first cycle of PDCA completes, we will need to finish assessing our effectiveness and plan for the future, all in an effort to reduce adverse patient outcomes.

References

