



Transforming surgical morbidity and mortality into a systematic case review



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ABSTRACT

Background/Purpose: The surgical morbidity and mortality (M&M) conferences at a regional children's hospital achieved the goals of case by case peer review and education for trainees but provided limited data for trending and analysis. In 2019, an institution-wide effort was initiated to create an electronic case review system with the goals of improving event capture and real-time practice performance feedback. Surgical M&M was migrated to this structured case review format to provide a platform for surgical performance improvement.

Methods: An online secure database was created with a 3-step classification system based on Clavien-Dindo severity score, peer review, and causality fishbone analysis. The data entered were available in an interactive dashboard. Retrospective tabulation of the 2018 M&M data was performed using the archived paper system used prior to 2019.

Results: For the calendar year of 2019, the division of pediatric surgery captured and categorized 193 complications in the case review system. The capture rate was 50 per 1000 surgical procedures. For a similar time frame in 2018, the capture rate was 35 per 1000 surgical procedures. The dashboard provided run charts of the incidence and types of complications by procedure and by surgeon. Similar trend data were not available in 2018. The dashboard output has made possible the creation of (non-risk adjusted) individual surgeon performance reports. The output has been used to direct process improvement projects and educational content.

Conclusion: Creation of an online database with interactive dashboard has allowed surgical M&M to evolve into a systematic case review that greatly facilitates quality improvement efforts. This system increased the event capture rate and provided novel practice performance feedback, resulting in process improvement projects and educational objectives predicated on the trending data. These electronic reporting tools are now available to all surgical divisions and represent a transformative approach to surgical case review.

Type of Study: Retrospective Historical control; Quality improvement.

Level of Evidence: Level III.

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Surgical morbidity and mortality (M&M) review has been a traditional forum for peer review for over 100 years. Ernest A Codman, M.D. (1869–1940) was a graduate of Harvard College and Harvard Medical School and is attributed with the development of surgical M&M. [1,2]

Codman was dedicated to a systematic review of cases, Morbidity and Mortality Conference (M&M) discussion forums, and creation of an error assessment and classification system. This departmental M&M conference is now a required curricular mandate for training programs and it has profoundly influenced surgical culture for the last 100 years.

In looking critically at our own surgical M&M at Children's Hospital

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Colorado which is a freestanding children's hospital, we found it fell short of a systematic review espoused by Codman. It had become largely an educational tool for residents and fellows much in line with national trends. [3–8]. We were not achieving routine quality improvement or quality assurance. Reliance on outcomes resources such as the American College of Surgeons National Quality Improvement Program – Pediatric (NSQIP-P) provides some data regarding institutional outcomes allowing for systematic quality improvement (QI). [9] But there remains a gap for individual surgeon performance evaluation regarding decision making and outcomes. There has been a growing body of QI research aimed at re-establishing M&M as a mechanism for improving patient outcomes [10–19]. We hypothesized that adding both system process changes along with a technological tool could improve our M&M review's capability of achieving education, quality improvement, and quality assurance with surgeon performance feedback.

1. Methods

Transformation of our M&M system started in January 2019 and involved both process changes and technological innovation. These changes were approached with the goals of improved event capture, standardization of review, action item capture, easy data review capabilities for trend analysis, and improvement in education. To illustrate the usefulness of the system, cases occurring in the calendar year of 2018 were compared to those from 2019. Prior to 2019, the pediatric surgery fellow was solely responsible for collecting cases and deciding which to present at M&M. They kept the case list in an excel spreadsheet, and cases reviewed at M&M were scored on paper sheets which were then stored in a folder. The paper sheets used a more simplistic severity score, the same peer review score, and a more simplistic causal analysis. Cases which were not presented at M&M remained in the fellow spreadsheet, and were not scored. There was not routine tabulation of the cases reviewed or upward reporting within the hospital.

1.1. M&M structure

A database described below was created for pediatric case entry by anyone within the institution. In the division of pediatric surgery, the majority of case entry is done by the trainees and the advanced practice providers (APP). Weekly reminders are sent to keep case entry timely. Institutional mortality and readmission reports as well as NSQIP collected events are reviewed to ensure completeness of case collection. At the time of case entry, the user assigns an objective severity score based on the Clavien Dindo classification system. (Table 1).

A biweekly M&M committee was formed to review all cases entered into the surgical case review database. This committee includes the categorical pediatric surgery fellows, subspecialty fellows, an APP representative, and a quorum of at least 3 attending faculty members. Each case entered is discussed and reviewed for any quality concern or for educational value. Cases without either objective are assigned a subjective peer review score and closed. (Table 2) Those with either a quality concern or educational value are not assigned a peer review score and are referred to the full M&M conference. The pre-review allows time to notify involved specialists from outside of the division when their input is anticipated to be valuable.

The full M&M conference occurs 1–2 times per month within the Pediatric Surgery Grand Rounds educational series and is attended by all

Table 1
Clavien-Dindo classification of surgical complications.

Grade	
I	Any deviation from the normal postoperative course without the need for pharmacologic treatment or surgical, endoscopic, and radiological interventions. Allowed therapeutic regimens are: drugs such as antiemetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy. Includes wound infections opened at the bedside.
II	Requiring pharmacological treatment with drugs other than allowed form grade I complications. Blood transfusion and total parenteral nutrition are also included.
IIIa	Surgical, endoscopic, or radiological intervention that is not under general anesthesia
IIIb	Surgical, endoscopic, or radiological intervention that is under general anesthesia
IVa	Life-threatening complication requiring intermediate care or intensive care unit management, single organ dysfunction (including dialysis, brain hemorrhage, ischemic stroke, and subarachnoid bleeding)
IVb	Life-threatening complication requiring intermediate care or intensive care unit management, multi-organ dysfunction (including dialysis)
V	Death
Suffix “d”	If the patient suffers from a complication at the time of discharge, the suffix “d” (for disability) is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication.

Table 2
Peer review scoring system.

Score	Definition
1	No concerns
2	Could question management but is within the standard of care
3	Identified a quality or management concern
4	Identified a serious quality or management concern that is outside the standard of care

trainees, APPs, and attending faculty. The fellows present assigned cases. A specific educational objective is chosen during the committee meeting and the fellows are instructed to limit their presentation to 5 slides with inclusion of 1 or 2 pertinent literature references. At the end of the M&M conference discussion, a peer review score is assigned. For cases with peer review scores of 3 or 4, an additional causal “fishbone” analysis is also performed. (Fig. 1) The fishbone separates more individual cognitive factors from systems issues. This allows for less contentious assignment of a high peer review score when systems issues were the main factor. It also allows for more subtle analysis capturing concerns of decision making which would not be captured in a pure outcomes focused database.

1.2. Surgical case review database

An online database platform was created. This is accessible only through the hospital intranet security purposes. The initial data capture includes patient identifying information, date and type of surgery performed, type of complication, a narrative of the events, and a severity score. Drop down menus for type of surgery and type of complication were created. These lists created buckets to be as inclusive as possible with the goal to assign each case to a defined bucket and avoid the use of “other.” We obtained legal advice that the content of the database would be privileged and confidential: subject to peer review and medical review protections, Colorado Statue 25–3-109 and therefore would not be discoverable.

Once a case has been reviewed at the committee level and/or full M&M, three more tiers of the database platform are accessed. For simple cases, the date of review and assigned peer review score are captured. For more complex cases, a causal “fishbone” analysis can be captured. In addition, action items can be assigned generating a recurring email prompt until the action item is closed.

1.3. Surgical case review interactive dashboard

An online interactive dashboard was created. Access to the dashboard is only through the hospital intranet and is limited to the surgical quality director and division chairperson. The dashboard shows all cases entered into the database, and can filter for any variable including date range, type of surgery, type of complication, surgeon, severity score, and peer review score. A list of patient identifiers can be generated based on the selected filters. (Fig. 2) This is also privileged as peer review protections.

1.4. Educational value assessment

Continued medical education (CME) conference feedback evaluations were compared between 2018 and 2019. Attendees were asked: Has this session impacted your performance? Response options were yes, somewhat, or no.

1.5. System change comparison

Cases for the calendar year of 2018 were abstracted from paper M&M forms and the fellow spreadsheet.. These cases were manually

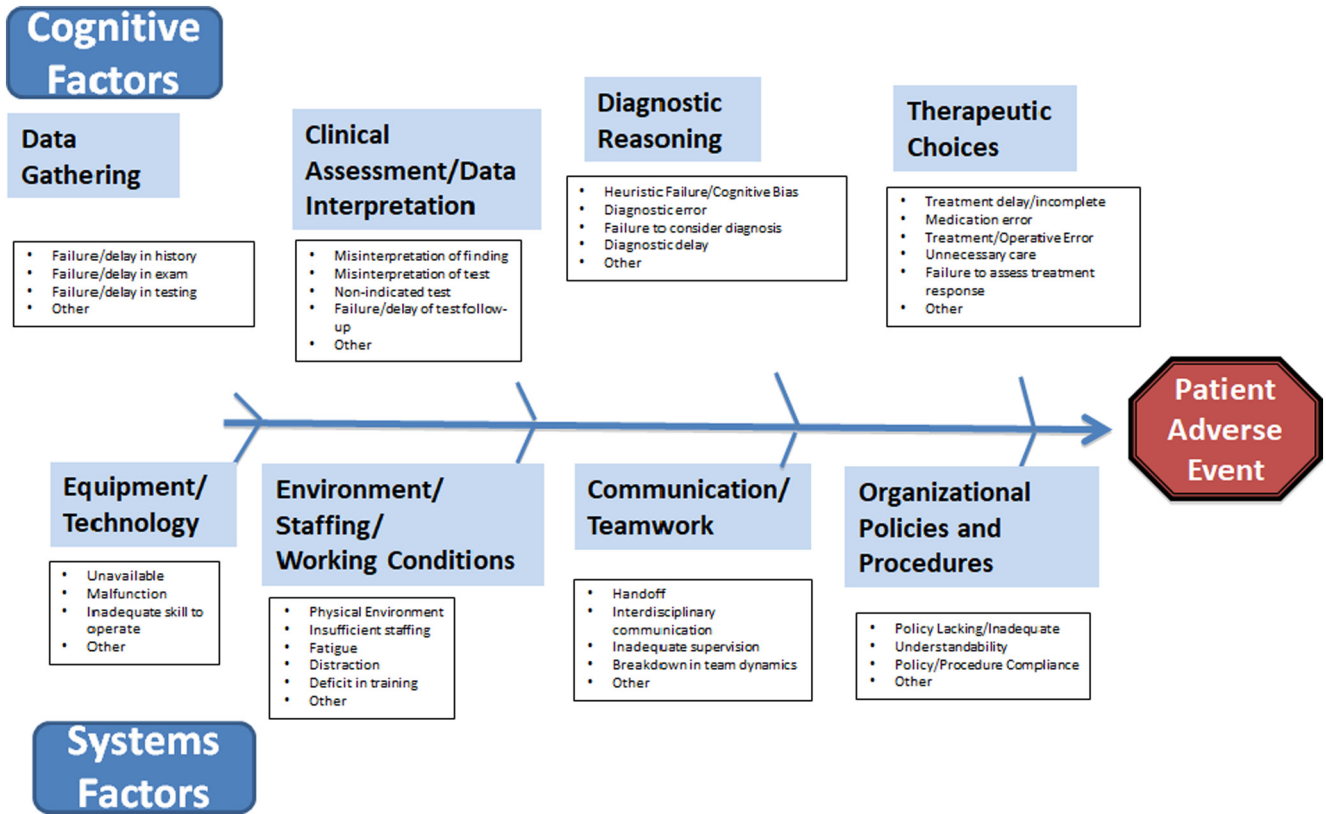


Fig. 1. Causal pathway to patient adverse event.

tabulated retrospectively to provide a baseline for comparison to the 2019 period during which the new case review system was used.

2. Results

2.1. Case capture for systematic review

For the calendar year of 2019, there were 193 cases entered into the on-line system. This represents an increase in case capture from 35 events per 1000 cases in 2018 to 50 events per 1000 cases in 2019. Of the cases captured, 60% were reviewed at M&M committee meeting, scored, and closed. The remaining 40% of cases were referred to M&M conference for full division discussion based on quality concerns or educational value. All cases captured were assigned both severity and peer review scores. In 2018, 16% of cases were not assigned severity or peer review scores as they were never discussed at M&M conference, and the M&M committee did not exist.

2.2. Education

CME evaluations for the pediatric surgery educational series were compared between 2018 and 2019. For the question specific to M&M conference: “Has this session impacted your performance?” respondents indicating “yes” significantly increased from 78% to 93% ($p = 0.01$). The number of cases reviewed at M&M conference for 2018 compared to 2019 decreased from 125 to 77 due to the M&M committee pre-screening cases and selecting those with the most value. This allowed for more thorough discussion, attendance by involved specialists from outside the division, and focus on specific educational objectives. Attendance at M&M conference did not change significantly as it is built into our required educational curriculum for all division members and is protected time where no clinics or surgeries are scheduled.

2.3. Quality assurance and quality improvement

The data from the interactive dashboard has allowed for creation of bi-annual surgeon specific reports for performance feedback which were not previously possible. These include number of cases performed, number of complications captured, and number cases of peer review scores of 3 or 4 with cognitive cause factors. Any case with a peer review score of 4 is referred to the hospital peer review committee. More than 2 events with peer review score of 3 or 4 for an individual surgeon in a 6-month period is referred to the division chairperson for further review.

The dashboard is also used to track trends on the type of complications by procedure type. Subsequently, it is used to track action items created by trend analysis. Action items have included cross disciplinary referral of cases, order set creation for systems issues, and targeting of educational topics when knowledge gaps are uncovered. Thus far, it has generated 6 quality improvement projects.

3. Discussion

The tradition of surgical M&M focused on educational value has allowed drift away from providing structured case review for quality assurance. Without the ability to analyze complications for trends, a system can fail to identify safety issues and clinical opportunities for improvement. While outcomes analysis such as NSQIP-P allow for system issue improvements, there remains a gap in individual surgeon performance evaluation. Revisiting the goals of M&M to improve patient care has been a focus in recent literature. Cromeens et al. reported a structure of categorization of M&M cases to systematize the failure mechanisms of cases reviewed. [19] Arca et al. demonstrated a QI initiative tracking patients in all phases of care. In the system presented here, we have tried to address both goals of systematic collection and systematic classification. [20]

This project initially started with the pediatric surgery fellows largely responsible for case collection. By providing an online platform

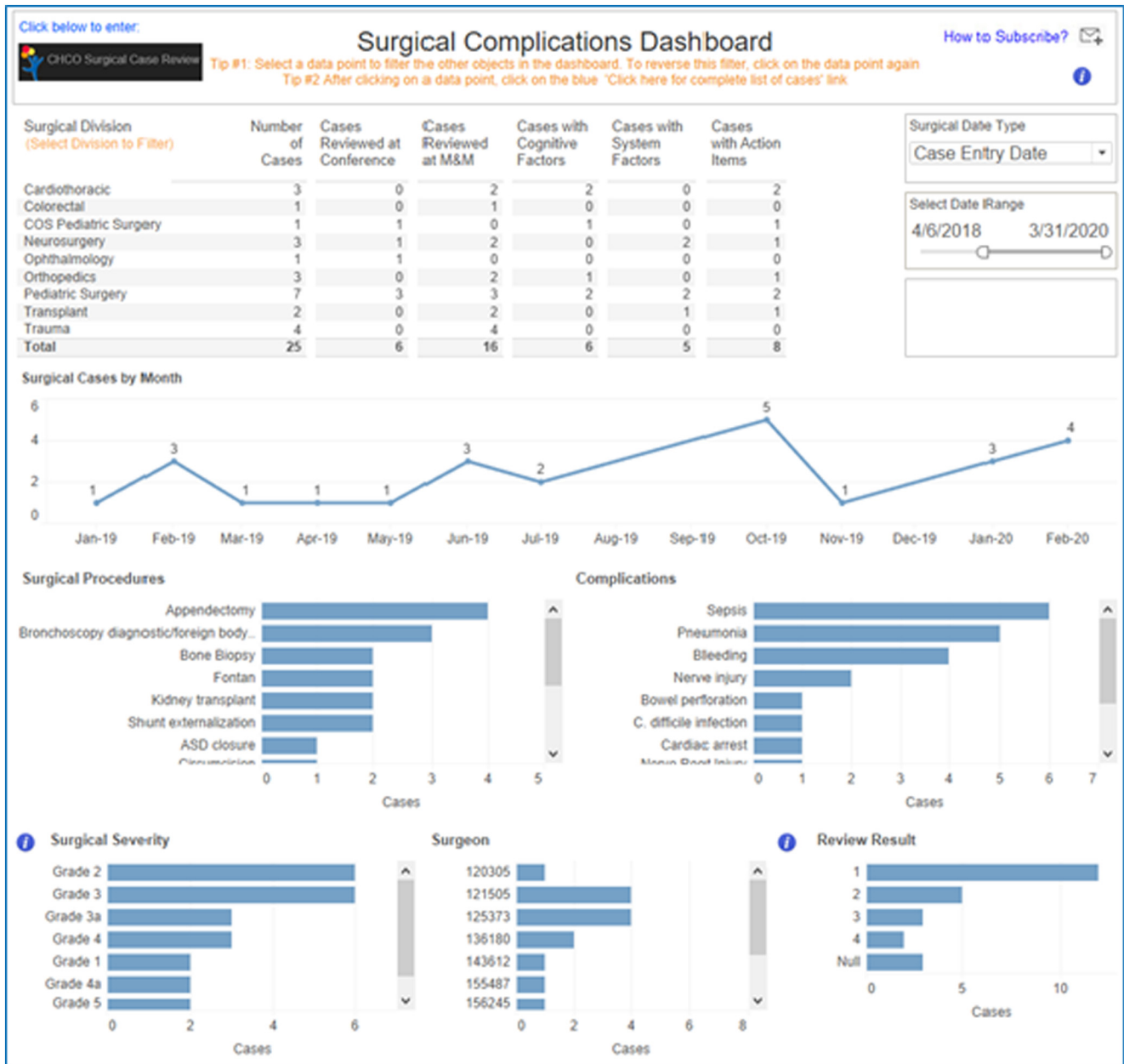


Fig. 2. Interactive dashboard output.

accessible by anyone in the institution, the likelihood of case capture is increased. Even institution members not within the division of pediatric surgery can enter a case and thereby refer it to our M&M committee for review. While this still allows for human error in case capture, it has increased the number of people responsible for case capture which creates a more sustainable system. While it is possible the increase in case capture was due to an increase in incidence of events, a review of NSQIP-P data for these time periods did not show an increased complication rate. Midway through this first year of the case collection system, we started cross referencing hospital-published reports of mortality and readmission as well as NSQIP-P identified cases. The process of identifying institutional sources of data to augment case collection is ongoing. Currently, case entry from these sources is a manual process. Ideally, there would be seamless integration of enterprise data in the system. In addition, it will be valuable in the future to track the percentage of cases identified from hospital data sources or NSQIP versus those identified by individual entry to understand potential weaknesses in the system.

The case review entry system and interactive dashboard have been constructed such that they are easily generalizable to other divisions. Each surgical division is now able to start using the system by submitting a list of procedure and complication categories. Ultimately, this will allow for immediate upward reporting with scoring and categorization of events standardized across the institution.

The process change of creating a two tier system of review with the M&M committee followed by the M&M conference has allowed improvement in the rate of case review and score assignment, as well as improvement in the educational value of M&M conference. A group of attending surgeons, fellows, and APPs perform preliminary review and discussion of the cases resulting in rapid cycle review and elimination of cases with low educational value. The preliminary review also improves M&M conference preparation by assisting the trainees with identification of education objectives and allowing for attendance of involved providers from outside the division.

Results of quality improvement and change in outcomes is certainly a limitation. With the ability to capture action items, we did generate 6

quality improvement projects. There has not been sufficient time to expect to see a change in outcomes. Also, since the database does not cross reference total surgical volume, we currently can only state incidence and not rates. These are planned for future upgrades to the database.

The combination of process change along with a technological innovation for case capture and categorization has greatly improved the QI and educational value of surgical M&M. These changes are generalizable across the institution allowing for the possibility of systematic case review.

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