

# An Eight-Year Analysis of Surgical Morbidity and Mortality: Data and Solutions

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In this article, a reproducible process for presenting, analyzing, and reducing early and late surgical morbidity and mortality (M&M) is detailed. All M&M cases presented from 1998 through 2005 at Monmouth Medical Center were categorized. Residents and nurses were empowered to report the complications. The five major categories were overwhelming disease on admission, delays in treatment, diagnostic or judgment complications, treatment complications, and technical complications. From the 53,541 operations performed over 8 years, 714 patients were presented, which included 147 deaths and 1,132 category entries. The most common problems were technical complications in 474 (66.4%) patients. The data have generated actionable solutions, many with low barriers to adoption, resulting in safer, less expensive surgical management. Surgical outcome benchmarks have been established and are used for credentialing surgeons. The "Hostile Abdomen Index" has been developed to assess the safest choice for abdominal operative access, pre- and intraoperatively. We explained the real-time process that generated solutions for the entire department as well as changes relevant to residency training and individual operative techniques.

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**S**URGEONS ARE NOW being forced to answer the questions: how good are we and how do we know? These unstructured questions are sometimes met with surgical angst and annoyance. The requirements of quality assurance, patient safety, error reporting, and remedies have been magnified by insurance and payor guidelines, consumer advocate groups, evidence-based medicine criteria, media, hospital control organizations, specialty boards, malpractice issues, credentialing measures, and residency training programs. Evolving pay-for-performance initiatives are not uniform. The angst associated with measuring how good we are or the quality of our surgery is complicated because there is no national agreement as to data sources or decision algorithms for those questions. In 1991, Brennan and Leape<sup>1</sup> noted that there was "a significant reduction in the overall rate of complications during the second part of the study period after feedback was given to the surgeons regarding outcomes." They also noted that "quality improvement based on outcomes data is usually easy, because obvious problems are identified and remedied." However, obvious problems may not be remedied without realistic understanding on the part of surgeons. As far as disclosing medical errors to patients, Chan<sup>2</sup> indicated that "surgeons used the word error in 57 per cent, took responsibility for the error in 65 per cent offered a verbal apology in only 47 per cent, and only 8 per cent discussed how similar errors would be prevented." An October 8, 2004 *Journal of the American Medical Association* study from the Agency for Healthcare Research and Quality<sup>3</sup> addressed surgical injuries and "documented 32,000 mostly surgery related deaths

costing \$9 billion and accounting for 2.4 million extra days in the hospital in 2000." The report further comments that, "The findings greatly underestimate the problem, since many other complications happen that are not listed in hospital administrative data."

To help address the unstructured quality questions, we have developed a process that quickly identifies the more common errors and defines actionable issues and solutions. We learned which issues were not major problems and, therefore, had lower priority for developing solutions. Our initiatives or changes that were adopted began with changes that had low barriers, and, therefore, were more acceptable. The changes that had low barriers were welcomed by surgeons. Surgeons took pride in data-based, improved results. Sometimes areas of quality work were revealed to be pleasant surprises, and evidence-based clinical results were more credible than anecdotes. Low-barrier permanent changes made patient management more efficient and were quickly adopted, in days. The language of safety culture was used on a daily basis throughout the hospital, and surgeons agreed that decreasing the risk of recurrent problems would always be a high priority. Many safety initiatives should pertain to a teaching or nonteaching environment. Many low-barrier changes could be scaled to a hospital system or state-wide program. Some low-barrier changes might require persistent individual surgeon counseling. In trying to answer who is responsible for most errors and how to correct them, we were interested in determining which factors could be attributed to surgical error, to other physicians, or to system process issues or to critical patient disease. McGuire<sup>4</sup> reported complications in 44,603 major operations and wrote, "Errors caused or contributed to half of all complications. Almost 80 per cent of errors were thought to have occurred during operations. Half were errors of commission and half were errors of omission. After 2500 general surgical admissions, Couch et al.<sup>5</sup> 'recommended concentration on adverse events in which most important

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lessons lie' and that 'all hospitals continuously survey final results to determine prevalence of avoidable misadventures'."

The crucial choice we have presented to surgeons is to self-analyze and control change or to be ordered to change by external agencies. Changes may be implemented by a departmental memorandum, departmental meeting, departmental policy and procedure additions, hospital edict, publication reinforcement, or surgeons' results reviews. These approaches are all locally based and local surgeons have influence on the rate of implementation of various changes. Outside forces directing change include the national organization requirements of the American Board of Surgery, The American College of Surgeons, and the Joint Commission on Accreditation of Hospital Organizations. Other outside influences include patient demands that doctors use new technologies, as well reveal surgeons' operative results. The insurance companies quest for pay-for-performance measures and Leapfrog measures also have direct hospital practice pressures. Although surgeons are more conscious of the quality and safety agenda, the medical malpractice morass continues to remain a sword of Damocles over the heads of surgeons.

At Monmouth Medical Center, a licensed 525-bed community teaching hospital, we approached the quality patient safety puzzle through morbidity and mortality conference (M&M) analysis. Within the Department of Surgery there are sections of general surgery, laparoscopy, colorectal, head and neck, plastic and reconstructive, pediatric, thoracic, vascular, urology, and neurosurgery sections. All patients who had complications from any of those sections were candidates for presentation at an M&M conference. There are several reasons for choosing M&M as a basis for subsequent complication analysis and corrections. The M&M is a familiar bridge for all surgeons because they attended those conferences during residency. The complications can be quickly registered on a one-page form and entered into a spreadsheet. Many issues or events that occur can be grouped into an undeniable problem set that can be investigated through root causes analysis, already familiar to hospitals. Frequently, the analysis leads to actionable remedies that have low barriers to permanent adoption. As a result, multiple hospital data requests as well as Joint Commission on Accreditation of Hospital Organizations inspections regarding outcomes are easily accessible. Surgeons' operating privileges and recertification are based on an analysis of outcomes and can be relevant to future pay-for-performance criteria. Doctors, nurses, and administrators are aware that decreases in perioperative complications are linked to huge opportunities in cost reductions. The object of our research was to delineate a methodology for obtaining and evaluating surgical morbidity data. We will highlight the reasons why we have made some of the more important changes, as well as the solutions we have applied.

### Materials and Methods

The complications were identified from the M&M data. The M&M conferences occurred at least three times per month and up to five cases were presented in each session.

There was a blank sheet of paper in the residents' library where any senior resident could record the name of a patient and any perioperative or late complication. The late complications are never reflected in conventional 30-day perioperative period. The Department Chairman was the moderator, and his cases were presented without his permission, as were all other surgeons' cases. Any physician in any department could have his/her complication presented if that patient needed to be "rescued" by someone from the Department of Surgery. Those physicians were invited to attend that M&M conference to supplement and clarify any points in the presentation. Guests were given advance notice, and occasional schedule conflicts were accommodated. The resident created a PowerPoint presentation and a hand-out of the summary of each case. Most often, the most senior resident involved in the care of the patient presented each case as well as pertinent references. The attendees included attending surgeons, surgical residents, medical students, the Chairman of Radiology, Quality Improvement-Risk Management nurses, and invited guests. The nurses would double-check our results through their independent committees and inform us when we "missed" a case. The nurses had the complete backing of surgeons to bring any complication or patient treatment dilemma to any department leader. Those nurses were the liaison to the Department of Nursing and communicated our suggestions regarding nurse management or personnel training or staffing issues. The nurses also relayed and reinforced messages from surgery to other departments regarding our policies and procedures or criticisms.

About 9 years ago, a "Characterization of Surgical Morbidity and Mortality" was developed to register each case on a form. There was no limit as to the number of "events" per case. The date of presentation; the patient initials, age, sex, and medical record number; the resolution, and the action recommended or a one-line summary were entered. These data were then transferred into an Excel spreadsheet and are summarized in Tables 1 and 2. Even if a complication was "expected," it was still reported. Because the residents usually rendered their opinions as to which events should be checked off on the sheet, there was real-time reinforcement and categorization of errors. This exercise was essential to enable a transparent process of quality improvement by error understanding, assimilation and change. Because the date of presentation was noted, we could easily track whether a complication decreased in incidence. Photographs or video clips of surgery were usually presented at the conference. In addition, our senior residents were given digital cameras since 2000 to document any unusual pathology in any setting. Those photographs were shown at conferences and were entered into resident portfolios. Each year, resident PowerPoint literature reviews at M&M have been compiled to update a CD. The resident's presentation was also appraised on a separate form by an attending surgeon. Those appraisals were reviewed with the resident at least twice a year.

### M&M Categories

The categories are listed in a temporal sequence starting from admission through surgery and postoperative care. As

TABLE 1. *Characterization of Surgical Morbidity Results (Categories 1–4)*

1132 Events in 714 Patients from 53,541 Total Surgical Patients	
Category 1: Overwhelming Disease on Admission	106 events
Cancer, 15; central nervous system compression, 4; (DIC), 10; infection, 17; trauma, 5; vascular, 31; other, 24	
Category 2: Reasons for Delay in Treatment	97 events
Not hospitalized in a timely fashion	11
Discharge too early from ED or hospital	14
Prolonged time on nonsurgical service	36
Prolonged time on surgical service	24
Family directive to delay/not permit surgery	12
Category 3: Diagnostic or Judgment Complication	116 events
Underestimation of disease severity	55
Nonconsideration of disease	35
Wrong system implicated	5
Wrong test ordered	3
Test misinterpretation	18
Category 4: Treatment Complication	300 events
Medication problem or drug reaction	13
Inadequate medicine/insufficient treatment	26
Medical complications	
Cardiac	64
Gastrointestinal	21
Hematologic	7
Multiple organ failure	15
Peripheral vascular	11
Pulmonary	
Pulmonary embolus	24
Respiratory failure	23
Pneumonia postoperative	8
Other pulmonary	7
Aspiration	4
Overaggressive treatment	53
Anesthesia problem	24

DIC, Disseminated intravascular coagulopathy.

will be elucidated, the results and frequencies of events were sometimes surprising to the physicians. The impact of the data has changed certain clinical pathways and technical approaches over the years, and these changes will be reflected in the results, as they evolved.

Category 1 is overwhelming disease on admission. Many patients arrived at the hospital with extreme physiologic abnormalities that often were irreversible with our current therapeutic options. There were, however, complications that compounded those patients' disease states, which also occurred in less ill patients. Those complications were investigated. The overwhelming states include cancer (terminal metastatic disease), central nervous system compression, Disseminated Intravascular Coagulopathy (DIC), infection (overwhelming sepsis), trauma (life threatening), vascular (large blood loss or vasculopathy), and other systems. The overwhelming disease category represents patients who should be considered the severe at-risk group. The patients who were not in the overwhelming category on admission but eventually had a complicated downhill overwhelming course were not included in Category 1.

Category 2 included reasons for delay in treatment. In temporal sequence, the first subgroup was those "not hospitalized in a timely fashion." They may represent patients who refused to enter the hospital earlier or patients who should have been directed to a hospital earlier by healthcare

workers. The second subgroup includes patients who were "discharged too early from the ED or hospital." To enter this filter, a patient had to be discharged too early and, as a consequence, incurred some complication. These cases should shed light on the efficacy of our emergency and medical and surgical staff regarding outcomes of surgical patient discharges from the ED and hospital. The third subgroup represents patients who spent "prolonged time on a nonsurgical service" before surgery was consulted. Again, only those patients who had subsequent morbidity were presented. Our study does not address any near misses or patients who might have spent prolonged time on a nonsurgical service without incurring morbidity. The next subgroup includes patients who spent "prolonged time on a surgical service," resulting in a delay in treatment and morbidity. The last subgroup in this category includes patients whose "family delayed or did not permit surgery."

Category 3 enumerates diagnostic and judgment complications. The first subgroup includes instances of an "underestimation of disease severity." The underestimation might have resulted in a more casual, or "wait and see" approach, that led to a downward spiral in the patient's clinical course. The subgroup "nonconsideration of disease" included any case where an unsuspected problem was never contemplated and the treatment algorithm would have been different. The "wrong system implicated" includes cases such as

TABLE 2. *Characterization of Surgical Morbidity Results (Category 5)*

Category 5: Technical Complications	513 events (total)
Bleeding and vascular	119 events
Peripheral vascular	28
Aorta	10
Carotid	11
Hematoma	16
Laparoscopy	24
Other surgery	30
Leaks, fistulas, obstruction, or stoma	95 events
Leak or fistula:	
Open surgery (all types)	35
Laparoscopy:	
Gastrointestinal	10
Cystic duct	10
Obstruction:	
Open surgery (abdominal)	22
Laparoscopy	11
Stoma complications	7
Closure	98 events
Wound infection:	
Open surgery (all types)	25
Laparoscopy	7
Abscess:	
Open surgery (abdominal)	29
Laparoscopy	11
Dehiscence	26
Catheter	53 events
Central line:	
Pneumothorax	15
Other	9
PEG tubes	10
Other catheters and tubes	19
Inadvertent opening in viscera	92 events
Open surgery:	
Enterotomy	
Unrecognized enterotomy	11
Enterotomy by gynecology	7
After evisceration	1
Bronchus, trachea/lung injury	8
Bladder, ureter injury	9
Others	8
Laparoscopy:	
Common duct injury	5
Enterotomies	26
Diaphragm injury	2
Endoscopy	15
Device, implant, or graft	48 events
Device and stapler	10
Implants:	
Pacemaker	12
Gastric bands	6
Stents	5
Breast implants	2
Drains	1
Graft (vascular)	12
Nerve injury	8 events

PEG, percutaneous endoscopic gastrostomy.

one who was thought to have a neurological spinal problem but really needed a vascular bypass for ischemia. Those patients who had morbidity resulting from the "wrong test ordered" prompted a review of more efficient patient management. The final subgroup was "test misinterpretation," which addressed cases where radiology reports were mis-

leading or incorrect and led to morbidity. The Chairman of Radiology and, frequently, other members of that department participated in our M&M conference because many cases required an accurate review of radiologic studies. The Department of Radiology was anxious to participate in the analysis, and was fully cooperative with the process. We had no true idea of the incidence of any of these subgroups and we shared our data, over the years, to expedite low-barrier changes.

Category 4 details treatment complications. The first subgroup was "medication problem or drug reaction." We were unaware of the actual incidence or major medication morbidities. We also tallied the instances of "inadequate medication or insufficient treatment" as a second subgroup. The third subgroup includes "cardiac, gastrointestinal, hematological, hepatobiliary, multiple organ failure, peripheral vascular, and pulmonary complications." Each of those groups has branches that have been further analyzed. For example, the pulmonary group has been divided into respiratory failure, pulmonary embolism, postoperative pneumonia, aspiration, and other miscellaneous causes. These subdivisions have focused attention on clinical scenarios that are preventable or require better diagnosis or different therapy. Every item that is scrutinized is evaluated as a chance for improvement. Another subgroup is "overaggressive treatment." These are patients where the lesson "less is more" is reinforced. We have presented cases where participants have all agreed that less aggressive surgical management would have been a superior judgment. The last subgroup in the treatment category incorporates "anesthesia problems."

Category 5 encompasses technical complications. These complications pertain to any invasive procedure. The first subgroup deals with "internal bleeding, hematoma, or vascular injury." The next includes "leak, fistula, obstruction, and stoma malfunction." These events could involve any part of the body and were studied in detail. The third subgroup encompasses "closure, infection, abscess, dehiscence, and foreign body" events. The next subgroup involved "catheter" problems such as central line pneumothoraces or PEG complications. The following subgroup, "inadvertent opening in viscera," highlighted cases such as those laparoscopic cases converted to laparotomy, as well as gastrointestinal endoscopic perforations that required "rescue" surgery. Another subgroup was "device, implant, or graft complications." The final subgroup, "nerve injury," lists patients as a result of operative injury or patient position on the operating table.

Each year the data were analyzed. Subdivisions of subgroups were created when several similar cases were batched. We reported to the Department of Surgery, Risk Management, Quality Improvement, and the hospital administration. Several subgroups were studied in greater detail, which led to specific improvements and reduction of recurrent complications.

## Results

The total events by year of the inpatient and outpatient complications are in Table 3. Of 53,541 patients in 8 years,

TABLE 3. *Inpatient and Outpatient 8-Year Complication Totals*

Year	Patients	M & M	M & M Percentage	Events	Events Percentage
1998	5,074	73	1.44	146	2.88
1999	4,648	72	1.55	125	2.69
2000	6,600	78	1.88	131	1.98
2001	7,252	82	1.13	129	1.78
2002	7,168	102	1.42	145	2.02
2003	7,800	102	1.31	155	1.99
2004	7,461	105	1.41	139	1.86
2005	7,538	100	1.33	132	2.15
Total	53,541	714	1.33	1132	2.11

714 (1.3%) had 1,132 complications that were presented at M&M conferences. Some of the 714 patients were listed in several subgroups because of disease cascades of morbidity. Less than two checks per page on average, however, were needed to characterize a patient. The actual time spent entering these data onto an Excel spreadsheet by a research associate amounted to less than 3 working days per year. There was considerable work necessary to analyze the data. Clinical research studies were created from data trends. Table 4 lists the 147 deaths by year and the M&M summary of the five major categories. In all categories, we tried to explore results from the standpoint of actionable remedies. We have been able to identify those patients who have had overwhelming problems, but some of those patients had additional complications that might also have contributed to a poor outcome. Many of those same events also occurred in patients with nonoverwhelming disease. It should be stressed that some of the 714 complications were found to be unavoidable, and no one from the health care team should be blamed. However, a review of events helped determine which events were preventable and perhaps which solutions should be suggested.

Each year, Category 5, "technical complications," was the most common category, even when subtracting "rescues" of other departments. Because there was a dramatic shift toward advanced laparoscopic surgery during the study period, we were able to analyze complications relevant to new procedures and to advise changes. Over 8 years, these adjustments involved patient management, operative techniques, and specific resident training modifications. Most of these adjustments initially were chosen because they had low barriers to change. Because technical errors represent a

significant proportion of the results, our report concentrates on that category.

Category 1, overwhelming disease upon admission, indicates that a vascular catastrophe was the most common problem. There were 93 patients who had 106 overwhelming issues, because some patients had more than one overwhelming problem upon admission. There were 61 patients (66.7%) who died, and 15 of those patients also had technical complications. We assessed any surgical complication apart from any overwhelming disease because that surgical complication might be preventable in other patients.

As far as the 621 patients without overwhelming disease on admission, there were 86 deaths. The causes of death and assessment of preventability will not be addressed in this article. However, we do know that of those 621 patients, 447 had technical errors (62.6%) and 36 of those died.

Category 2 details 97 reasons for delay in treatment. Only 11 patients were "not hospitalized in a timely fashion," and only 14 were "discharged too early from the ED or hospital." Although others were sent out of the ED or hospital too early, they were not registered in the study unless they were presented at an M&M conference because of ensuing surgical morbidity. There were 36 patients who spent "prolonged time on a nonsurgical service" and 24 who "spent prolonged time on a surgical service" before definitive treatment. The "family delayed or did not permit surgery" 12 times.

Category 3 explains the 116 diagnostic or judgment complications. The first subgroup, the largest, was "underestimation of disease severity" and represented 55 (47.4%) and was associated with 29 deaths. Root cause analysis applied to M&M conferences helped to determine what part of any "event" contributed to a patient's hospital course. There was "nonconsideration of disease" in 35 (12 of those patients died), "wrong system" in five patients, and "wrong test" ordered in three.

The 18 "test misinterpretations" were specifically incorrect radiology reports. The incidence of 2.25 cases per year appears acceptable. Because the Chairman of Radiology is present at all conferences, we have been able to institute several permanent changes that have affected our outcomes. One insight stimulated by M&M conferences was that there were too many calls necessary to finally notify a surgeon about a life-threatening CAT scan finding of a patient in the ED. The chain of communication includes radiologist to a secretary, to ED secretary, to ED physician, to a secretary,

TABLE 4. *M&M Summary by Year and Category*

Year	Died	Category 1	Category 2	Category 3	Category 4	Category 5	Total
1998	19	21	16	23	31	55	146
1999	20	23	7	16	33	46	125
2000	23	12	21	11	33	54	131
2001	15	5	10	10	33	71	129
2002	22	10	6	9	48	72	145
2003	17	7	14	19	37	77	155
2004	15	8	10	6	38	77	139
2005	16	20	13	22	47	61	162
Total events		106 (9.4%)	97 (8.6%)	116 (10.2%)	300 (26.5%)	513 (45.3%)	1132
Total patients	147						714

to referring primary care physician’s office secretary, to primary care physician, to surgeon’s secretary, to surgeon, to radiologist office, to radiologist. In a patient with a ruptured aortic aneurysm, these 11 or more links often caused a delay that was associated with severe morbidity or death. All of the departments agreed that when there was a life-threatening radiology report, the radiologist would directly contact an appropriate surgeon. Other referrer notification could take place after the patient was headed toward the operating room. The radiologists were aware of practice referral patterns and we had little trouble convincing doctors to comply. Another issue prompted by M&M regarded CAT scans for pregnant patients with an acute abdomen. The radiologists created a protocol that all departments considered safe and expeditious.

Category 4 identified 300 treatment complications. Clearly, some of the complications listed were not preventable, such as a totally unexpected postoperative myocardial infarction. On the other hand, data analysis revealed a group of patients who might have benefited from certain preoperative medications.

“Medication problem or drug reaction” occurred in 13 patients and there were eight heparin-related complications. “Inadequate medication or insufficient treatment” occurred in 26 with cases such as inadequate fluid management or nonplacement of a vena cava filter. During the course of the M&M study, we reported a 2-year study, *Reducing Medication Errors in a Surgical Residency Training Program*.<sup>6</sup> We have used this information to reduce the “occurrence of knowledge deficit medication errors.” We are not suggesting that most of the medication errors in our study were resident errors, but in analyzing our data, we decided to investigate the resident errors that were detected by the pharmacy.

Our tracking method revealed problems such as line sepsis with central hyperalimentation. Concomitantly, we noted that certain patients with widely metastatic disease who were about to go to hospice had been started on hyperalimentation. Surgeons at our institution were responsible for inserting central lines and writing the orders. We studied 118 consecutive hyperalimented patients in 2002 and found that 31 (27%) had metastatic disease and had not been proper candidates for hyperalimentation. In addition, only 26 of the 118 patients had hyperalimentation for 14 days or longer. Also, 21 of 118 had line sepsis. We shared our findings with oncologists and we agreed to no longer hyperaliment that group of patients. In addition, steps were taken to successfully minimize central line sepsis.

Based on impressions of prior M&M conferences, it was not anticipated that the third subgroup of 184 medical complications would be larger than the medication errors group. In the cardiac group, we noted 64 perioperative myocardial infarctions in 8 years. We reviewed preventive efforts with our medical staff, including preoperative β-blocker indications.

There were 21 gastrointestinal treatment issues such as the ineffective treatment of *Clostridium difficile* colitis. Fifteen “other,” 11 colonoscopic, and 4 endoscopic retrograde cholangiopancreatography (ERCP)-related perforations are listed only in Category 5, “technical errors.” Seven hema-

tologic problems were related to diseases, including hemophilia and DIC. The three hepatobiliary complications related to other ERCP complications. Multiple organ failure occurred in 15 patients and none survived. Eleven peripheral vascular problems mostly affected patients who developed deep venous thromboses in the hospital.

There were 66 pulmonary complications, including 24 pulmonary emboli, 23 respiratory failures, 8 postoperative pneumonias, 4 aspiration pneumonias, and 7 other respiratory complications. Those seven patients had events such as ventilator problems. Of 66 patients, only 7 had overwhelming disease, therefore, there probably was opportunity for improvement in 59 other patients. In addition, 23 of 66 patients also had technical complications.

The subgroup of overaggressive treatment involves 53 patients who had unnecessary surgery, too complicated a procedure where a simple procedure was indicated, or overmedication. These cases were discussed in detail at the M&M conference and no repeated pattern was attributed to any particular surgeon.

There were 24 anesthesia complications over 8 years. The anesthesiologist for a given case contributed to the discussion after each presentation. Direct interdepartmental interaction was essential to carefully delineate events and create pathways to improve care. Anesthesia problems included 8 monitoring, <sup>7</sup>reintubation, <sup>6</sup>intubation, and <sup>3</sup>aspiration have even led to a review of the supervision policies of the anesthesiology department. Other topics, including hypothermia prevention and management, effective use of blood products, and pH monitoring, were stimulated by the conference.

Category 5, technical errors, as mentioned earlier, was the largest category and there have been many technical improvements over the 8 years. There were 513 events in 474 patients, and 51 (10. 8%) died. The technical complications by subgroup are presented in Table 4. There was no instance of wrong-sided surgery.

*Surgical Rescues*

Table 5 shows the 51 surgical rescues over 8 years. They were patients with intraoperative or procedural complications who were rescued by a surgeon from our department. The urgency, stress, and difficulty of that type of case gave opportunities to praise the rescuer. The rescued guest phy-

TABLE 5. *Surgical Rescues*

Service	Rescued	Rescuer
Anesthesia	1	0
Cardiology	2	0
General surgery	6	25
Gastroenterology	19	0
Gynecology	9	0
Interventional Radiology	4	0
Neurosurgery	1	0
Orthopedics	4	0
Pediatric Surgery	0	1
Thoracic Surgery	1	4
Urology	2	7
Vascular Surgery	0	12
Total	49	49

sician always attended our meeting and was accountable for the complication. Gastroenterologists were rescued for 11 colonoscopic and 4 ERCP perforations and 4 other problems. The ERCP complications provoked us<sup>7</sup> to study the indications and complications in 200 consecutive patients over 20 months, from May 1999 to December 2000. Although the complication rate of 12 per cent was similar to other studies, the study emphasized that ERCP should usually be performed as a therapeutic maneuver, especially in view of the subsequent development of magnetic resonance cholangiopancreatography (MRCP) for biliary diagnostic purposes. The most common intraoperative rescue was for gynecologists who caused seven inadvertent enterotomies. The most frequent rescuers were general surgeons (25) and vascular surgeons (12).

#### *Technical Complication Subgroup Results*

In the first subgroup of technical complications, bleeding was the most common technical complication, occurring in 119 patients. Other complications were 28 operative and percutaneous peripheral vascular, 10 aorta, 11 carotid, 16 hematoma, 24 laparoscopy, and 30 other open surgical complications. Early in the study, it was apparent that patients who had gastrointestinal bleeding on the medical service typically were transfused with many units before a surgical consult was called. This often led to very compromised operative candidates and very stressed families. The "last ditch" effort conversation of surgeons and families was preventable. We agreed that if any patient has gastrointestinal bleeding and one unit of blood was ordered, a surgeon should be consulted. Coordination of care and stress levels was better controlled for all involved. Because of several cases of uncontrolled esophageal variceal bleeding were presented at an M&M, we taught all residents how to find and use the Blakemore tube. We recognized that because this entity is not common in our hospital, we should add management of various tubes to the resident orientation session.

Because vascular surgery is developing more endovascular solutions, we will be able to compare the incidence of future complications with our historical data. There were eight ruptured aortic aneurysms, one aortic injury during a T8 corpectomy, and one case of aortoduodenal fistula exsanguination. Some of these patients would now be managed with endovascular stenting and perhaps less morbidity. There were 632 patients who had carotid endarterectomies in 8 years and 6 had strokes and 5 had bleeding from the wound. There was one death. These results will be compared with a future series of patients who have carotid stenting instead of surgery.

As far as hematomas prompting further surgery, eight occurred after breast surgery, four after hernia repairs, and four after abdominal surgery. There were 24 laparoscopic active bleeding events in 4532 patients who had laparoscopic surgery in 8 years. In most cases, surgeons have taken photographs or created a DVD during laparoscopy to document the pathology, the surgical maneuvers, or the rationale for conversion to open surgery. We also know that there have been four iatrogenic splenectomies during laparoscopic

procedures and the last one was in February 2003. There have been four instances of iatrogenic splenectomy during open abdominal surgery. There was a total of 30 cases of active bleeding in open surgical cases from all sections of the department.

The next subgroup of technical complications includes leak, fistula, obstruction, and stoma malfunction, and there were 95 episodes of these in 8 years. With regard to open surgery, there were 17 fistulas after colon surgery, 5 small bowel fistulas, 4 after gastric surgery, and 9 others. There was only one enteric fistula in 2005. With laparoscopic surgery, there were 10 fistulas after colon surgery and only 1 of these in 2005. In 2003, DVD and photo analysis of cases with subsequent fistulas revealed that too much fat had been incorporated in the stapled anastomoses.

We have also had 10 patients who were readmitted for leakage from cystic duct stumps that were treated with CAT scan-guided drainage and/or ERCP stenting. There were seven stoma complications that required reoperation.

One of the types of obstruction involved gastric bypass patients who had retrocolic gastrojejunostomies. Within the first 70 patients, 4 developed obstructing retrocolic internal hernias and 4 developed an obstructing retrocolic cicatrix during the first year after surgery. The surgeon performing those laparoscopic operations then changed technique in early 2002 to an antecolic anastomosis and has eliminated the problem. The concern of that surgeon and his willingness to change was an example to other surgeons. Over 2 years later, Hwang<sup>8</sup> reported a similar experience, indicating "In the current series, changing the position of the jejunal bypass limb from retrocolic to antecolic significantly decreased the overall incidence of small bowel obstruction because it eliminated one of the most common sites for obstruction: the mesocolon." Over the past 5 years, there were 322 laparoscopic bariatric cases performed by one surgeon, including 209 gastric bypasses and 113 gastric bands. One advantage of the M&M format is that it allowed us to capture complications during initial hospitalization as well late complications prompting readmission. Therefore, we were able to include more complications relevant to a procedure than just the 30-day postoperative course. Aside from the first group of retrocolic complications, there were three bleeding complications during surgery, two perforations of the roux limb at 6 months, one bleeding anastomotic ulcer, and one ischemic bowel at 3 years postoperatively. There were no leaks and no deaths with any bariatric operation. As far as the gastric band group, there were three patients who had a gastric prolapse and three who had a band obstruction, months after surgery. Subtle suture anchoring modifications appear to have eliminated those two problems.

In the last section of the subgroup, we have listed 33 patients who developed postoperative intestinal obstruction related to recent laparotomy (22) and laparoscopy (11). There were also seven stoma reoperative problems.

The next subgroup detailed wound, abscess and closure problems. Only major wound infections were discussed at conference. Wound infections managed in a surgeon's office, or as an outpatient in the ED, were not captured in our data. If, however, a culture were obtained, that patient was

identified by the nurses monitoring infections and was reported in the Quality Improvement committee. There were seven abdominal wound infections after laparoscopic surgery, seven after open hernia surgery, six after open intestinal surgery, five after breast surgery, and seven other site infections. There also were 12 (1.2%) pelvic abscesses after 1028 open appendectomies and 5 (1.2%) after 416 laparoscopic appendectomies. There were also 17 other abdominal abscesses after all types of open surgery and 6 after other laparoscopic surgery.

The last postoperative wound complication tracked was dehiscence. From 1998 through February 2002, there were 24 cases, and from March 2002 through December 2005, there were only two cases. We have debated the utility of retention sutures over the years and there are many papers written on the "best" closure. Surgeons agreed to use retention sutures more often, based on the collated patients who dehisced. In addition, the increase in laparoscopic surgery has avoided laparotomy in many patients who would have been at risk for potential dehiscence.

The fourth subgroup of technical complications concerns 53 catheter complications. During the first 3 years of the study, there were nine pneumothoraces caused by subclavian central line access. The vascular surgeons introduced ultrasound-guided internal jugular line placement, which eliminated any further pneumothoraces. Some attendings still prefer a subclavian approach for portacath placement. Of the 1256 portacaths placed, there were 6 pneumothoraces and 7 other portacath serious complications presented. Included in the catheter section are 10 complications that occurred in 637 PEG cases. The ability to track even "minor" procedure outcomes facilitated refining techniques and stressed pitfalls that led to significant morbidity. Technique alerts that we have promoted have been adopted by our surgeons and reiterated in the operating room to our residents.

The fifth subgroup consists of 92 inadvertent openings in viscera in all types of open surgery and laparoscopic abdominal surgery. After open abdominal surgery, there were 11 unrecognized enterotomies that required reoperation and 7 bowel injuries recognized in the course of gynecologic surgery that required rescue by a surgeon. There were also six bladder, three ureter, and eight respiratory tract associated injuries.

In 8 years, there were 4532 laparoscopic cases and 1 death. Of these, 2271 were laparoscopic cholecystectomies with 4 common duct lacerations, 1 divided common duct, 9 inadvertent enterotomies, 3 with trocars, and 6 during dissection of adhesions. There were also two injuries of the diaphragm. In the remaining 2261 laparoscopic procedures, there were 9 enterotomies during bowel surgery and 7 during ventral hernia repair.

Over the initial 5 years of the study, *A Hostile Abdomen Index for Laparoscopic Surgery* (Table 6) was developed. The index was meant to guide surgeons regarding prospective patients for abdominal surgery. The object was to promote the safest choice of operative access for patients. The preoperative score can be made at the first patient encounter and relates a patient's medical history and physical examination to the likelihood of an uneventful laparoscopic pro-

TABLE 6. *Hostile Abdomen Index Scores*

## Preoperative Score Criteria

1. No prior surgery, no abdominal hernia, and no skin disease or infection
2. One prior laparotomy or hernia in region of intended surgery
3. Two prior laparotomies, extremely large or small patient, acute abdominal wall infection, coagulation defect, portal hypertension, history of abdominal radiation, or history of intestinal Crohn's disease
4. More than two laparotomies, history of abdominal abscess or diffuse peritonitis, large abdominal solid mass, large mesh in area of intended surgery, bowel obstruction and extreme distention, failed prior laparoscopy from adhesions, ascites, previous radiation in intended surgical region, severe, active Crohn's disease, hemodynamic instability, severe COPD, late pregnancy, or acute abdominal wall infection in port region

## Intraoperative Score Criteria

1. Normal anatomy other than surgical disorder
2. Omental adhesions
3. Localized visceral adhesions in area of surgery or iatrogenic injury—no laparotomy required
4. Massive diffuse adhesions or conversion to laparotomy

COPD, chronic obstructive pulmonary disease.

cedure. Those criteria are graded 1 through 4 with increasingly hostile abdominal challenges. Once the laparoscope is introduced into the abdomen, the intraoperative score is assessed by the surgeon, from 1 to 4, based on increasing hostile abdominal conditions. We applied the scores to laparoscopic complications that were presented at an M&M from 1998 through 2003. In Table 7, laparoscopic complications are listed relative to the pre- and intraoperative scores. In the preoperative Group 4, 15 of the 19 injuries were inadvertent enterotomies. We have only scored the patients who have had complications and we do not know the distribution of preoperative scores for all laparoscopy cases. We<sup>9</sup> have reported inadvertent enterotomies in our hospital from 1998 through 2004. The sharing of the data with our surgeons has provided a rationale and warning as to the dangers of proceeding with laparoscopy in a very hostile abdomen. As surgical techniques evolve, some difficult conditions that currently prompt laparotomy will eventually be safe with a laparoscopic approach.

Over the 8 years of our study, the overall laparoscopy complication rate was 2.4 per cent. In 2005, there were only 4 intraoperative complications in 819 cases. The volume of laparoscopic surgery has increased over the years, as has the complexity of the cases, but intraoperative complications have decreased.

Many of the 11 colonoscopic perforations were transferred to the hospital from outside offices. All of these patients required emergency surgical rescues. There were four ERCP perforations, and two required rescue surgery.

Another subgroup of technical complications encompasses problems with devices, implants, and grafts. There were 10 device staple failures that occurred in laparoscopic (7) and open (3) surgery. We learned early that when a stapler fails, the device parts should be given to the nurse in charge who should send it to the biomedical engineering

TABLE 7. *Hostile Abdomen Index Pre- and Postoperative Scores and Complications (1998–2003)*

Intraoperative Score	Preoperative Score 1	Preoperative Score 2	Preoperative Score 3	Preoperative Score 4				
4	Bleeding Staple failure, late bleed CBD injury Enterotomy Failed procedure Port incarceration Total	4 2 3 1 1 1 12	Cystotomy Enterotomy Total	1 1 2	Bleeding Enterotomy Staple failure Total	6 2 1 9	Enterotomy Cystotomy Staple failure Bleeding	13 1 1 1
3	Bleeding CBD injury Diaphragm injury Enterotomy Total	2 2 1 1 6	Bleeding Total	2 2	Bleeding Staple failure	1 1	Enterotomy Cystotomy	2 1
2	None	None	None	None	None	None	None	
1	None	None	None	None	None	None	None	

CBD, common bile duct.

department. Risk management staff should also be notified. The device should not simply be handed over to a device company representative.

The implant subgroup noted that pacemaker and gastric bands were listed most frequently. There were six pacemaker-associated pneumothoraces, and three pacemaker infections that required removal. There was one pericardial tamponade, one thoracotomy necessary for insertion, and one subclavian vein thrombosis. In 2003 and 2004, three gastric bands were removed because of obstruction, and three were removed because of prolapse. Subtle gastric suture fixation changes have eliminated these gastric band complications since then. Ten peripheral vascular grafts thrombosed and required reoperation, two were removed for infection, and one vascular stent clotted and led to surgery.

The final subgroup of technical complications includes eight patients who have had nerve injuries in 8 years. Two patients had brachial plexopathy from arms hanging off armboards during surgery, two phrenic nerves were injured, and there was one vocal cord paralysis, one facial nerve paralysis, one traction-induced femoral neuropathy, and one persistent spinal leak.

### Discussion

The tabulation of events in Tables 1 and 2, using the "Characterization of Morbidity and Mortality" form, has promulgated many changes in patient management. Surgeons' emotional displays and posturing during the M&M were rare, and appropriate good humor was encouraged to keep all comments in perspective and to help keep constructive criticisms on track. An opinion had to be backed up with literature, and the request for literature support was followed-up in later conferences. An evidence-based medicine perspective should be part of the culture of safety. The complications related to surgery have included immediate and delayed complications to reflect a complete assessment of an operation. The transparent method of acquiring data by the resident's unedited listing in the resident library and the multiple layers of nurses from quality management have promoted a culture that searches for actionable safety improvements. The process of complication analysis described

here used a one-page data entry form. To document about 100 cases per year required several days of work and was inexpensive. The presentations of the residents began the data entry procedure. Each resident's performance of a presentation was also annotated on a separate form to provide further feedback to improve residents' communication skills. Large hospitals with too many cases for M&M presentation have a choice. Either just the cases presented can be tallied on the M&M sheets or every case that can possibly be presented is tallied anyway. Either way, many actionable events can be prioritized. A baseline performance can be established and trends in practice will stand out. Those hospitals without residents have a quality improvement nurse equivalent who can be properly empowered to gather data. Also, all hospitals have coding personnel who search the charts for accurate and complete reimbursement charges, and could also gather complication data. Although they may not feel comfortable documenting more subtle issues such as overaggressive treatment, the nurses would be able to register most of the complications. All of these surgical data must be checked by a surgeon. Every one of the six competencies of the ACGME Outcome project was inherent to our approach. We also surveyed attendings and residents as to "conditions where a surgical resident should consider contacting the surgical attending." The residents' phone skills regarding a patient's course as well as the residents' M&M presentation appraisal were part of the feedback regarding communication skills. Resident-induced problems were uncommon, although the resident took ownership of the case presentation. In addition, since July 2003 when the 80-hour resident work week was mandated throughout the United States, we found no evidence that the frequency of any complication due to residents was different compared to before July 2003.

Some changes in the department were affected with a simple memorandum distributed to a particular subspecialty group. Other changes were introduced, debated, and codified at meetings, and some guidelines were written into the Policy and Procedures of the Department. One such guideline had to do with scheduling "add-on procedures" to minimize delays. Most surgeons are anxious to operate "ASAP,"

but when there are conflicts with several emergencies, operating room availability can lead to confrontations between surgeons. We have created a guideline that has resolved how to prioritize scheduling "add-on cases" and is detailed in Table 8. Another guideline, the "Operating Room Team Checklist," in Table 9, developed as a result of multiple operating room logistic challenges that had contributed to morbidity. This list reviews medication and equipment readiness before the "time-out procedure." After the time-out, the invasive monitoring devices, cautery, suction, and frozen section options are checked. We think that the team checklist review improves team communication. We also try to encourage the surgeons to give a preoperative surgical briefing of the indications and intended procedure, as well as a postoperative debriefing as to the conduct of the surgery.

The data over the years stimulated research projects and publications that reinforced the validity of certain approaches to treatment. Because the M&M data could quickly recall any single case or group of cases, the Chairman was able to reasonably credential and recredential surgeons based on outcomes. During private Chairman-surgeon correction sessions, the surgeon was usually asked "Tell me how many more of . . . (complication) you want, before you change?" A surgeon was then asked "What do you think you should do differently?" Most surgeons did not have to be told what to do differently because he/she knew the options discussed at the conference. Consensus opinions of overaggressive surgical management were communicated in a noncombative, nonpunitive way. The final question sometimes necessary to put a case in proper perspective was, "what would you do, in the future, for someone in your family?" Specific technical errors were also reviewed, and DVD recording of cases and intraoperative photographs helped identify crucial procedural errors at these sessions.

At our institution, of the 147 deaths, 86 patients did not have overwhelming disease on admission and they represented opportunities for improvement. The study of our complications indicates that the majority of surgical morbidity was related to physicians' management. Although there were sporadic events associated with the departments of radiology and anesthesiology, as well as medication problems, these issues were not the major problems. Aust,<sup>10</sup> however, applied the National Surgery Quality Improvement Program (NSQIP) formula to a civilian organization at the University of Texas Health Science Center at San Antonio. He found that "the risk factors that patients bring to

the operating room account for the majority of operative deaths." Jurkiewicz counters in the discussion of the paper, "So complexity to me is both intrinsic to the procedure and extrinsic and relates to the individual performing that particular operation. Nowhere in this formula do I see that represented." Khuri et al.<sup>11</sup> wrote that "Intraoperative variables were not as important as complications and preoperative risk factors in determining survival after major surgery." We have also found that important areas for improvement involve preoperative delays in consultation or action, underestimation of disease severity, nonconsideration of disease, postoperative treatment complications, and overaggressive treatment. However, our results indicated that technical procedure complications represented 513/1132 (45%) of all events and were present in 474 of 714 or 66 per cent of the patients presented. Technical complications contributed to 51 deaths, which were 34.7 per cent of the 147 deaths. Spencer<sup>12</sup> in 1978 stated, "I have actively participated at weekly Mortality and Morbidity Conferences over the past 15 years at several universities, and I have been repeatedly impressed by the significant percentage of cases that are related purely to errors in surgical technique. The actual frequency is probably underestimated. It cannot be known how often a wound infection, phlebitis, protracted ileus, or even intestinal obstruction from adhesions requiring reoperation were from unavoidable factors or to a clumsy, careless technique, with rough handling of tissues, excessive tissue necrosis, and inadequate hemostasis."

Dr. Martin and Dr. O'Leary<sup>13</sup> in an editorial opinion point out that Dr. Codman in 1900 "assigned each complication to categories such as error in technique, error in management, or patient's disease." They continue, "If more of Dr. Codman's admonitions had been heeded, we would now have less need to develop a system of outcomes research because one would have already been established." We feel that the remedies for decreasing the risk of a procedure can be improved the most by refining a surgeon's operative judgment and technique.

In 2003, Strasberg<sup>14</sup> wrote, "in summary many technical innovations appear to be introduced in a manner that might not optimally protect patients who are subjects of these procedures." He indicates that "Early detection requires compilation and assessment of outcomes in an orderly manner." Allen and Desimone<sup>15</sup> studied complications in the article, "Valid peer review for surgeons working in small hospitals." All 11,761 cases were entered into a database, and "We measured complication rate, patient education, resource utilization, use of diagnostic testing, and number of days the patient returned to work." The article stresses that "QSS is a group of peers that have a common goal to improve quality. There is no backstabbing, and there are no financial disincentives to membership, which is voluntary." We also have found that once surgeons have seen increased efficiency linked to improved patient safety, system and individual nonpunitive changes become more welcomed and even expected. Low-barrier solutions or "low hanging fruit" should be the first targets, and some of those are listed below.

In a 2003 editorial, Andrus<sup>16</sup> wrote "no reporting system can do as much as we in the medical profession can at our

TABLE 8. *Emergency Add-On Procedure Priorities*

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Purpose: Establish triage for emergency surgery
Policy: Categories based on case severity
Surgeon contacts charge nurse, then
Class 1: Immediate surgery. Hemodynamic instability/ shock, life-threatening limb trauma, massive blood loss, acute ischemia, perforated viscus, necrotizing fasciitis, threatened airway
Class 2: 1–6 hours, Small bowel obstruction, open fractures, appendicitis, major wound debridement/sepsis
Class 3: 6–18 hours, Hemodynamically stable patients, clotted access grafts

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TABLE 9. *Operating Room Team Check List*

Preoperative breathing treatment		
Blood available/type and cross		
Intravenous access		
Antibiotic		
Steroid		
Anticoagulation		
An assistant		
Equipment available:		
Special table	Cameras/scopes	X-rays available
Anti-DVT device	Full CO <sub>2</sub> tank	Fluoroscopy available
Warming devices	Ultrasound	Endomechanicals
Instruments/specialty	Laparotomy tray	Mesh/stents/grafts
Implants	Specialty tray	Pacemaker/magnet present
	"Time Out" Procedure	
Foley catheter	Suction working	
Nasogastric tube	Frozen section notification	
Cautery settings set	Specimen verification	
For Pediatric Cases		
Room temperature >100		
Heating lamp in room		
Bird bath for solutions		
Warming blanket on table		

own institution to improve patient care. . . . in settings that have a successful, effective track record, like the weekly Surgical Morbidity and Mortality conference." The Institute of Medicine in 1999<sup>17</sup> advised "identifying and learning from errors through the immediate and strong mandatory reporting efforts, as well as the encouragement of voluntary efforts, both with the aim of making sure the system continues to be made safer for patients." The experience of the surgeons proceeding along learning curves, and the clear understanding of the dangers of the hostile abdomen have contributed to the improved results.

Hospitals today have many people dedicated to check charts for legible signatures, and dated and timed notes and orders, and improper abbreviations. However, to achieve a significant improvement in patient safety and surgical outcomes we should focus more on major morbidities in each hospital. Those hospitals who can afford electronic medical records are fortunate, and many chart documentation problems can be eliminated. But most hospitals do not have electronic medical records. Besides, the hospitals that do have electronic medical records, still may have many of the complications detailed in this report.

One of the outgrowths of complication analysis was that it was possible to prevent intraoperative complications by intraoperative consultation. At Monmouth Medical Center, in 2003, two way televideo connections were installed that allowed communication between a hub and four operating rooms, pathology, ED and the intensive care unit. There was also a connection with the Chairman's office and home. The televideo laparoscopic digital image was the same as that seen in the operating room. The digital transmissions when requested by surgeons have enabled real time consultation, regarding difficult operative situations. As a result of the early success of this program, it seemed that televideo monitoring of surgeons starting to operate at our hospital, was a partial solution to help determine the level of operative

skills. The televideo monitoring facilitated credentialing of two surgeons.

We have implemented changes as they have become apparent through our analysis. Many improvements evolved because of low barriers to change. Some of the changes are summarized below:

#### *Process Changes for the Entire Department*

These changes included: Built close cooperation between surgeons, residents, other departments and nurses to create a culture of safety and constant improvement; Empowered residents and nurses to gather early and late complications; Accepted complication review and non punitive remediation approaches; Provided rapid, detailed data for hospital inspections and other reports; Facilitated clinical research projects with M&M data gathered; Developed privilege and credentialing outcome measures for surgeons; Established Outcome benchmarks for multiple types of surgery; Implemented direct surgical consult communication for an emergency radiology report; Instituted mandatory surgical consult, if a GI bleeding patient has one unit of blood ordered; Avoided hyperalimentation for patients with end stage metastatic disease; Agreed to CAT scan protocol for pregnant patient with acute abdomen; Monitored ERCP indications; Analysis adopted by two regional hospitals; Modified analysis categories for other departments; Reviewed anesthesia supervision policies; and Developed priority list for emergency add-on procedures.

#### *Changes Regarding Resident Training*

These changes included: Afforded multiple avenues for addressing the goals of the six competencies; Strengthened resident training in skills lab for laparoscopic techniques, suture techniques, cut down maneuvers, various tube and

catheter usage, ultrasound practice; Reduced medication errors in a surgical residency program; Surveyed "Conditions where a surgical resident should consider contacting the surgical attending"; Gave senior residents digital cameras and operating loops; Improved resident M&M presentation performance with feedback appraisal; Collected resident power point literature reviews, yearly on CD; and Showed no apparent change in complication frequency caused by residents due to 80 hour resident work week.

### Technical Operative Changes

The technical operative changes that were implemented included: Developed the "hostile abdomen index" to address laparoscopic injury prevention; Started televideo real time intraoperative consultation and credentialing; Introduced "Operating Room Team Checklist"; Replaced subclavian approach with internal jugular puncture with ultrasound access, eliminating pneumothoraces; Switched from retrocolic to antecolic gastric bypass avoiding post op obstruction; Refined gastric band technique avoiding post op obstruction; Decreased postoperative dehiscence with increased use of retention sutures; Altered colon anastomotic technique preventing leaks; Established surgical device malfunction protocol; and Reviewed surgical rescues of various specialties

Moorman<sup>18</sup> in his address titled "on the quest for six sigma," implores, "Can you reliably state your systems of care can trap and mitigate an error before creation of harm? Have you really embraced the mandate that we work diligently to eliminate errors and create an environment of safety? Can you erode the barrier inherent in the rigid hierarchy we ourselves create?" In conclusion, we have portrayed our 8-year experience in the Department of Surgery, at Monmouth Medical Center. We have provided a method of tracking and cataloging complications, and have presented our solutions. We hope to report on more recent developments, as we continue our journey.

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