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NARRATIVE REVIEW

Surgical Outcome Improvement Programs and the Role of National Surgical Quality Initiative Programs

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ABSTRACT

The National Surgical Quality Initiative Collaboration Program was started by the American College of Surgeons in the early 2000s with the aim of reducing and minimizing surgical complications by adopting a universal guideline based on collective retrospective data collections of various surgical groups throughout the United States. They applied these guidelines and evaluated the improvement in the number of surgical complications of various surgical procedures performed in the member hospital. As the number of participating hospitals increased, member hospitals started reporting to a state wide program under the American College of Surgeons guidance.

The idea was that multiple institutions within a state would achieve better outcomes than a single institution alone. Since its implementation, the program has been used in reducing postoperative infections in colorectal surgery, hernia surgery, gastrointestinal surgery, breast surgery, and so forth. In this report we reviewed the various initiative programs taken by participating hospitals to identify risk factors which may contribute to a higher morbidity and or mortality and draw certain guidance with the aim of reducing undesirable outcomes.

The implementation of these guidelines and their outcome at our institution in the state of Michigan will be discussed as an example of this novel experience.

Keywords: Surgical infection, Surgical Quality program, American College of Surgeons.

Introduction

Quality assessment and improvement are critical to surgical practice, and the data collected whether prospective or retrospective needs to be of high reliability and accuracy for the achievement of the above purposes.

Currently, the American College of Surgeon initiative in creating the database in 1991 was a rewarding experience for surgeons, institutions, and mostly to the patients undergoing surgery, whether it is post operation complications in particular infections, and length of stay, readmission rate, or mortality[1].

THE AMERICAN COLLEGE OF SURGEONS NATIONAL SURGICAL QUALITY IMPROVEMENT PROGRAM
(ACS-NSQIP) is a nationwide initiative that generates prospective surgical outcome data for patients treated at participating hospitals in the USA[2].

THE AMERICAN COLLEGE OF SURGEONS-NATIONAL SURGICAL QUALITY INITIATIVE COLLABORATION PROGRAM
(ACS NSQIP) was developed from a successful Veterans Affairs project and a pilot study was performed from 2001 to 2004 in a few academic hospitals to test whether the model could be applied to nongovernment centers. Successful results in this study led to expansion of the program. In the most comprehensive study on improvement that used ACS NSQIP, investigators looked at all participating centers and all operation types from 2005 to 2007, but this was done early in the program, when there were far fewer member hospitals than today. A similar, more recent study was performed but was limited to member hospitals of a single-state quality collaborative.

Based on the above principle, various states started their own similar program[3,4] and the collected data were used to establish a guideline aiming at reducing complications, readmission rate, and improving overall outcome and quality of care. Furthermore, with rapid expansion of the NSQIP program, a contemporary investigation of the impact of NSQIP on quality metrics is important to ensure that improvement is replicated on a wide scale beyond the initial cohort. One such initiative program adopted by the state of Michigan is the Michigan Surgery Quality Initiative Program (MSQC), which encompasses a clinical database of surgical cases of participating hospitals including rural, urban, academic, and private medical centers in the state of Michigan.

The program is expanding rapidly and is distributed widely by geography and hospital type with more than 434 current members in 42 states and three countries[3]. Member hospitals received semi-annual reports detailing their risk-adjusted outcomes compared with all other de-identified member hospitals. A driving concept is that the information on outcome will be used to direct improvement efforts relevant to the local institute. Trained clinical reviewers enter into a database information on patient demographics, medical comorbidities, preoperative laboratory values, surgical details, and perioperative events. A systemic audit process has shown the accuracy and validity of the NSQIP data[1]. Examination of this nationwide database allows for the risk stratification of patients and meaningful comparison of 30-day complication rates among hospitals[6]. Surgical outcomes available for study include hospital length of stay[7], blood transfer requirements during surgery and the subsequent 72 hours postoperative period[8], as well as the details of complications including 30 day postoperative mortality[9]. All participants in the program will have access to and to request the use of the nationwide de-identified participant user files.

These data were successfully used by researchers for gastrointestinal surgery[10], blood transfusion outcomes[8], breast cancer, therapy outcome[11], outcomes of surgical transplantation[12], and so forth.

All members participating in the American College of Surgeons National Surgical Quality Initiative Collaboration Program (NSQIP) had dedicated and certified surgical clinical reviewers who went through a rigorous training and education to ensure the quality and integrity of the collected data submitted to the American College of Surgeons.

The purpose of this review article, which primarily focuses on effective methods, researchers, educators, and specifically surgeons sought after in their quest to improve the surgical outcome of their patients and set a future guidelines standard that surgeons may implement successfully in their practice.

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Methods

We searched the midline on articles published in the last decade which primarily used the information from the American College of Surgeons' data bank, which primarily focused on quality issues that surgeons faced with on a daily basis while caring for their patients such as: wound infection, blood transfusion, anastomotic leak, readmission rate after colon surgery and so forth. We added our own experience at our community hospital as a successful methodological example.

HENRY-FORD GENESYS HOSPITAL EXPERIENCE
Michigan Surgical Quality Program (a state wide program sponsored by the American College of Surgeons - Michigan chapter) established guidelines to be implemented on all elective colorectal procedures, which our institution adopted in 2017; included mechanical and chemical bowel preparation, enhanced recovery protocol usage, limited postoperative opiate usage, early patient mobility, pre-operative education on the use of incentive spirometer and discontinuation of tobacco usage, and a change of gloves by the surgeon and assistants before abdominal wall closure. In addition, adopting a recovery protocol by allowing clear liquids up to 30 minutes before procedure, nothing by mouth 2 hours before surgery[13], actively out of bed within 2 hours post surgery.

We investigated trends in the outcomes of patients undergoing major GI elective colon surgical resection procedures during a 6 year period. Specifically, we hypothesized that hospitals in ACS NSQIP would have decreased risk-adjusted morbidity and mortality over time for major GI oncology resections.

Between 2017 to 2022, we carried out a retrospective data collection on our 800 patients who went for elective colorectal surgery at our institution between 2012 and 2022 and compared those who underwent the procedure (400 patients) with the MSQC guidelines to those who had surgery ten years prior to the guidelines implication (400 patients). The results showed that there is a significant reduction in superficial and deep wound infection[14]. We concluded that the protocol implemented (i.e. enhanced recovery program, changing gloves before closing the abdominal incision, early mobility, and early feeding) are worth the effort to reduce morbidity, however, mortality remain unchanged[14].

COLORECTAL SURGERY
Advances in surgical technique have allowed for lower pelvic anastomoses, which are at higher risk of anastomotic leak[15]. The reported incidence leak of 12-39%, and mortality of 2-24%, in such patients[16-21] had forced many surgeons to consider diverting ileostomy to mitigate the clinical significance of anastomotic leak[22-27]. However, there is a morbidity and mortality associated with the stoma creation, which reports as 19-66% (16-20%). Furthermore, the presence and need for a second procedure to close the ileostomy had its physical and psychological effects on the patient[15].

Jafari et al in 2013[9] collected the ACS-NSQIP data on ileostomy creation and specifically looked at complication rate followed by low anterior resection (LAR) in rectal cancer. Their findings clearly demonstrated the significant morbidity associated with diverting ileostomy among those patients with the readmission rate of (20 vs 11%), a higher rate of infection (7.5 vs 5.3%), and progressive renal insufficiency (2.1 vs 0.8%). However, they have a lower return to the operating room (4.2 vs 7.6%). There was no difference detected in terms of 30-day mortality rate, hospital length of stay or septic complications.

The post colectomy readmission rate remains one of the important metrics in evaluations of successful management of such patients and a thirty days postoperative readmission rate is one of those metrics. Heusly et al in 2016[3] use the data base from the ACS-NSQIP, (upstate New York data) to assess the 30 day readmission rate after Colorectal Surgery and identified several risk factors that contributed to the readmission rate of such patients and could be a target for intervention such as preoperative smoking cessation program, optimization of diabetic management, mandatory scheduled follow-up appointment post discharge and ostomy care pathway.

ONCOLOGICAL SURGERY
Perioperative morbidity and mortality in surgical oncology as well as long term outcome is vital for discussing comprehensive patient care. High volume in specialized centers caring for such patients will ultimately result in better outcomes, nonetheless smaller regional and low volume

canter will continue to take off such patients largely because of patient desire and financial pressure. In addition, even at high volume centers, the complications particularly after a major oncological operation, remains relatively high indication that focus in quality improvement should be directed not only on who is operating (surgeons in large volume center vs surgeon at low volume center), but also on how they are operating (quality outcome metrics)[28].

With that in mind, the ACS-NSQIP database regarding perioperative outcome in oncologic surgery is clearly a valuable source. Lucas et al in 2013[28] carried a data collection of oncologic surgery procedure from the ACS-NSQIP data (excluding the emergency procedures and patients with metastatic cancer) and looked at the primary outcome of any complications with the exception of bleeding and mortality rate. Results of collected data of more than 70,000 patients from a participating hospital reveal a decrease in the rate of complication by 4-6% each year, but no change in the mortality rate of those patients who went for major gasto-intestical oncology operations. Furthermore the number of complications per patient also decreased by 1.9% annually. These findings should encourage all hospitals, regardless of the number of procedures done to participate in such a quality measurement program and the subsequent collected data should direct the effort in reducing complication and improving outcome at the institutional level.

Neoadjuvant radiotherapy for pancreatoduodenal cancer[29], the impact of Body Mass Index on postoperative outcomes in patients with rectal cancer[30], morbidity following simultaneous colorectal and hepatic procedures for colorectal cancer[10], and short term outcomes following surgery for anal cancer[1].

The database availability to the surgeons and their institutions greatly help in drafting guidelines and recommendations that ultimately will benefit the patients and society.

BREAST CANCER

Breast cancer is the most common cancer in females in the United States. There is generally a low incidence of postoperative morbidity and mortality following breast surgery (1% or less). However, reports of 2-3% complication rates for lumpectomy and 5-50% for mastectomy, as documented in the literature[3-7]. Postoperative wound infection is the most frequently encountered complication, resulting in additional procedures, prolonged length of stay, delayed cosmesis, and ultimately patient distress.

The American College of Surgeons National Quality Improvement Project (ACS-NSQIP) established a 30-day risk-adjusted surgical outcomes database in 1991, which included more than 200 sites across the United States. This valuable database has proven to be extremely helpful when considering quality improvement programs within institutions.

In 2012, Blacam et al. conducted a retrospective collection of ACS-NSQIP data for a two-year period (2005-2007)[11], which encompassed 26,988 patients who underwent breast cancer surgery. They found the most common complications (5-6%) were superficial and deep wound infections, with independent risk factors for high rate of infection were high body mass index, smoking, and diabetes[11].

This study highlights the significance of large data collection by The American College of Surgeons in assessing outcomes in breast cancer surgery and thus enhances and supports the guidelines for prevention of post operative surgical complications.

TRANSPLANT SURGERY

National Surgical Quality Initiative program data bank resources represents an increasingly powerful tool for transplant surgery and has the potential to transform the quality of care for the transplant recipient.

RENAL TRANSPLANTATION

Renal transplantation is one of the earliest successful surgical transplantations and significantly improved survival rate for patients with end stage renal disease. One of the commonest complications post transplantation is urinary tract infection (15%-50%)[31-40]. Amara et al utilized the National Surgical Quality Improvement Program (NSQIP) database to assess the rate of urinary tract infection post renal transplantation between 2017 and 2020 and found that overall 30 days infection rate was 6.1% (n=312), with a variation of 0-12.9% in the five centers included in the study. The use of ureteral stent, duration of urinary catheter, and

female gender were all independently associated with higher urinary tract infection. However, these factors can explain only 17% of the variation in rate of urinary tract infection. Future collaboration and comparison of practice between various institutes will help in reducing these complications.

National Surgical Quality Initiation Program data bank resources represent an increasingly powerful tool for transplant surgery and has the potential to transform the quality of care for the transplant recipient for the better.

HEPATIC TRANSPLANTATION

Liver transplant remains the treatment of choice for the cure of acute and chronic liver failure with significant improvement of graft survival over the years, while post hepatic transplant complications remain a common occurrence. Data collected from NSQIP on 90 days post liver transplant complications from 29 centers between 2017-2019 by Amara et al in 2022[12]. showed a total rate of complications between 38% of 1684 deceased donor recipients - 47% of 109 living donor recipients). The most common complication (19%-31%) included hemorrhage requiring reoperation (4%-9%), and vascular complication (6%-9%). These data collected by NSQIP of complications in both deceased and living donor liver recipients will help in finding solutions for improvement. Other programs include post hepatic transplant primary complications [41], variations in outcome after liver transplant[42], and predictive value of risk indices for cardiac complications in living donor liver transplantation[43].

BLOOD TRANSFUSIONS

The National Blood Collection and Utilization Survey report estimated that more than 15 million units of blood were transfused in the United States in 2008, and about 11% of which were used during general surgical procedure[44]. Colo-rectal Cancer Surgery accounts for a significant number of general surgical operations[45] and their blood transfusions requirements (20%-28%)[46-48]. Using the large database collection by the ACS-NSQIP, Halabi et al in 2013[8] examine the recent available data at peri operation blood transfusions in colorectal surgery, and assess the short term outcomes associated with peri operative blood and preoperative anemia and to build a predictive model for blood transfusion protocol considering all available preoperative and operative variables.

The results reflect an extensive data on the detrimental effects of blood transfusion on disease- free and overall survival rate after Colorectal Cancer[49-53]. However only a few studies examined the effect of blood transfusion on short-term outcomes after Colorectal Cancer Surgery (such as infection rate, longer ventilatory assistance, longer hospital lengths of stay and increased mortality and morbidity[51,54-62]. These single institution studies were limited in patients number and did not address the recent finding that preoperative anemia was shown to be all independent factors in increasing the 3-day mortality and morbidity in surgical patients[63] and although blood transfusions may be beneficial in patients with preoperative anemia, it has a detrimental effect in other groups of patients with certain comorbid conditions and identifying patients with the critical level of hemoglobin that mostly benefit from blood transfusion.

In conclusion, The American College of Surgeons' initiative program to start collecting data from multiple institutions in the states allows each state to have its data bank with collection of various surgical procedures and adopted guidelines for the best outcomes, which ultimately improve patient safety and satisfaction. It is imperative that personnel collecting and entering the data at the level of participating hospitals must go through rigorous training and education to assure quality and accuracy of the data collected and submitted to the American College of Surgeons data bank.

Conflict of Interest Statement:

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