



Building a Center for Abdominal Core Health: The Importance of a Holistic Multidisciplinary Approach

Austin P. Seaman¹ · Kathryn A. Schlosser² · Daniel Eiferman² · Vimal Narula² · Benjamin K. Poulouse² · Jeffrey E. Janis³

Received: 22 November 2021 / Accepted: 31 December 2021
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Abstract

Background This article seeks to be a collection of evidence and experience-based information for health care providers around the country and world looking to build or improve an abdominal core health center. Abdominal core health has proven to be a chronic condition despite advancements in surgical technique, technology, and equipment. The need for a holistic approach has been discussed and thought to be necessary to improve the care of this complex patient population.

Methods Literature relevant to the key aspects of building an abdominal core health center was thoroughly reviewed by multiple members of our abdominal core health center. This information was combined with our authors' experiences to gather relevant information for those looking to build or improve a holistic abdominal core health center.

Results An abundance of publications have been combined with multiple members of our abdominal core health centers members experience's culminating in a wide breadth of information relevant to those looking to build or improve a holistic abdominal core health center.

Conclusions Evidence- and experience-based information has been collected to assist those looking to build or grow an abdominal core health center.

Keywords Multidisciplinary care · Abdominal core health · Abdominal wall reconstruction · Holistic care

Introduction

It is estimated that over 500,000 ventral, incisional, and umbilical hernia operations are performed per year in the USA.^{1,2} Patient complexity includes individual comorbidities such as diabetes, smoking, obesity, and poor nutrition, and hernia factors such as size, location, contamination, and history of recurrence.^{3,4} In this context, complications range from 29 to 63.6%,^{4–8} representing a significant financial burden on the health care system, and an unmeasured impact on patient health. Beyond the immediate complications, the

rates of recurrence and the vicious cycle of complications that can follow unsuccessful repair create an additional financial burden on the system⁹.

A reduction in the recurrence rate of ventral hernias by 1% is estimated to result in an annual cost savings of 32 million US dollars alone.¹ Therefore, any effort to reduce the recurrence rate and other potential complications can have a significant effect on reducing the financial and economic impact of these cases. Several studies have shown that specialization improves surgical outcomes, such as open-heart surgery, vascular surgery, and coronary bypass, while the increased volume of many procedures, including pancreatic resections, esophagectomy, pneumonectomy, and pelvic exenteration has an inverse relationship with complications and overall mortality.^{10–12} This has also been shown for abdominal wall reconstruction (AWR) which is defined as abdominal hernia repair with intent to restore anatomic alignment of musculature, often utilizing tissue rearrangement and myofascial release. A multidisciplinary approach to AWR has shown benefit with details of this approach previously described.^{13–16}

✉ Austin P. Seaman

✉ Jeffrey E. Janis
Jeffrey.janis@osumc.edu

¹ The Ohio State University College of Medicine, Columbus, OH, USA

² Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH, USA

³ Department of Plastic and Reconstructive Surgery, The Ohio State University Wexner Medical Center, Columbus, OH, USA

Despite the advantages provided by a multidisciplinary approach to AWR, ventral hernia is proving to be a chronic disease. In a follow-up to a randomized controlled trial evaluating the use of mesh for ventral hernia repair, at 10 years after repair, recurrence was greater than 30% regardless of mesh use.¹⁷ This rate is likely higher in real-world conditions outside of tightly controlled clinical trials. As such, an array of techniques should be utilized to address these issues over time for maintenance of abdominal core health (ACH). The concept of ACH moves away from defining a field by a single disease process (hernia) and shifting the focus to health maintenance. As abdominal wall specialists, this allows incorporation of the true breadth of practice including the management of hernia, abdominal wall tumors, diastasis, core muscle injury, and hernia prophylaxis. Therapies include a familiar array of surgical interventions to address these issues and also include physical therapy, exercise therapy, therapeutic yoga, and acupuncture. In addition, ACH emphasizes the natural connectedness of the components of the abdominal “core” including the anterior abdominal wall, lower back, diaphragm, and pelvic floor. Coordination of specialists within a Center for Abdominal Core Health should adhere to these principles which distinguish the effort from “traditional” hernia centers.¹⁸ A successful Center for Abdominal Core Health includes the known components of hernia and complex AWR centers and expands the breadth of practice by including specialists in all aspects of maintaining ACH. This requires philosophical buy-in from various practice groups and requires an investment at the institutional level to ensure brand identity, adequate resources, and care coordination. This article aims to provide a comprehensive perspective detailing the multidisciplinary and holistic approach required for success of a Center for Abdominal Core Health.

Components of a Center for Abdominal Core Health

The foundation of a center for ACH includes health care providers that are committed to these patients, specializing and coordinating care in concordance with best practices, and incorporating innovative ideas. In addition, clinical decisions and referrals are made keeping in mind the holistic and inter-connectedness of the components of the abdominal core. A center based at an academic hospital has been shown to be of benefit, but is not a requirement for success¹⁹. The incremental growth of a center will integrate additional specialists into care and will create a truly multidisciplinary practice to optimize patient outcomes. The multi-level coordination of care will maximize the potential of preoperative assessment, preoperative optimization, the operation itself,

postoperative hospitalization/recovery, and postoperative rehabilitation.

Preoperative Assessment

Initial patient assessment is generally performed by the clinic team of a general and/or plastic surgeon. Additional surgical consultants, specific to a patient’s disease process, include colorectal surgeons, bariatric surgeons, surgical oncologists, urologists, and gynecologists. Close coordination and communication with anesthesia is also paramount. Dependent on the patient population and referral pattern of an institution, multiple surgical providers may hold integrated clinical days designed for collaborative operative planning. The training and utilization of office staff including schedulers, administrators, and advance practice providers may identify patients appropriate for combined clinic, obtain relevant patient records and imaging prior to appointments, and maximize efficiency in the outpatient setting.

Advanced practice providers (APPs) play a critical role in preoperative assessment. As care guidelines are created, they can be relied on for preoperative assessment as extensions of the surgical team and interim assessments as patients undergo preoperative optimization, allowing surgeons to focus on patients that are prepared for surgery, thereby maximizing efficiency. The efficient outpatient triaging of patients is critical. A reasonable strategy is to have APPs establish care with patients who at first do not meet criteria for elective AWR including smokers, patients with a body mass index greater than 40 kg/m² or greater, or diabetic patients with an Hgb A1C level > 7.4%. Close coordination with call centers, clinic schedulers, and appropriate patient messaging is paramount. As patients approach preoperative optimization goals and targets, they are transitioned to preoperative planning with the surgeon. Finally, a transparent mechanism for getting patients back to the surgeon once optimized is critical.

The implementation of multidisciplinary conferences in the model of oncologic “tumor boards” allows complex patients to be reviewed by a team of experts, including surgeons, radiologists, and any other needed specialists to arrive at the optimal coordinated plan for patients. This also encourages frequent discussion of technique and approach among the various team members, with opportunities for innovation and teaching, promoting a unified strategy for managing AWR.

Preoperative Optimization

Preoperative optimization of complex hernia patients is crucial to long-term success and requires a multidisciplinary approach.^{18,20–23} Improved preoperative health leads to improved recovery time, decreased complications, and

decreased recurrence rates across multiple comorbidities. On an institutional level, a decreased length of stay, decreased postoperative complications, and improved patient satisfaction impact financial gain and referral patterns of future patients. This is evidenced in the Cox et al. article which showed patients with multiple preventable comorbidities (PCM) had a complication rate of 62% vs. a rate of 28% in patients without comorbidities after AWR, with a cost difference of \$33,665.59²⁴ per index hospitalization, and a cost difference sustained in the setting of no complications. Potential optimization includes weight loss, smoking status, diabetic control, and chronic pain management. Risk stratification can be performed based on the individuals' factors using an established grading scheme.^{25–27}

Counseling patients about the effect of their PCMs and managing expectations based on them is critical to building a strong patient-provider relationship.²² Weight loss is recommended prior to elective hernia surgery, as higher BMI is associated with increased rates of surgical site occurrences, infection, recurrence, and postoperative respiratory failure.^{28–32} Medical and surgical weight loss referrals are utilized based on patient preference and anatomy. Smoking cessation is important as using tobacco has been associated with wound healing complications and can be managed by primary care providers (PCPs), specialty smoking cessation centers or clinics, or pharmacy.^{33–36} A preoperative nicotine urine screening test may be implemented selectively or as universal policy. Poor glycemic control in diabetic patients is also associated with complications and can also be managed appropriately by PCPs, or endocrinologists if needed, with a goal of the HgA1C being ≤ 7.4 .^{37–41}

The importance of nutritional status cannot be overlooked. Low albumin has been associated with a tenfold increase in rates of infection after abdominal wall reconstruction.⁴² PCPs and registered dietitians can help optimize nutritional status with a goal serum albumin ≥ 3.25 mg/dL, and a prealbumin ≥ 20 mg/dL to decrease complication rates, length of stay, and rehospitalization.^{43–47} These providers can also play a key role in patients with sarcopenia, a combination of progressive loss of lean body mass with associated functional impairment. Sarcopenia can be diagnosed by evaluation of preoperative CT scan. It has been associated with poor outcomes, including a threefold risk in hernia occurrence in patient undergoing oncologic AWR.⁴⁸ A protein intake of 1.5–2.5 gm/kg/day combined with resistance exercises provides the best chance for preservation of functional status following major surgery.^{20,23}

Preoperative management of chronic pain may include pain specialists, psychotherapists, and pharmaceutical management. Additionally, colleagues in integrative medicine can offer patients traditional and non-traditional means of chronic pain management. It is important to minimize the use of chronic preoperative narcotics as it is associated with

increased use of postoperative opioids, leading to increased length of hospital stays, increased readmission rates, and increased risk of infection and wound healing complications.⁴⁹ This is best managed in coordination with pain management specialists and physical medicine and rehabilitation physicians, who frequently enlist physical and occupational therapists.

Physical therapists (PTs) play a crucial role in preparing patients for a successful perioperative course. Increasing preoperative frequency of exercise has been associated with decreased risk of complications in patients undergoing hernia repair.^{50,51} These specialists are best suited for improving the exercise capacity of these frequently deconditioned patients on a case-by-case basis to optimize outcomes. Their importance cannot be overlooked as increasing the strength of the abdominal core muscles and pelvic floor prior to surgery improves outcomes.^{51–53}

Radiologists or interventional neurologists can assist by administering preoperative intramuscular botulinum toxin for abdominal wall paralysis. There is emerging data suggesting it can help to improve outcomes by lengthening and relaxing the laterally retracted abdominal muscles.^{54–56}

Risk of surgical site infections (SSI) by methicillin-resistant and methicillin-sensitive *Staphylococcus aureus* can be reduced with the use of mupirocin nasal ointment and chlorhexidine soap preoperatively,^{57–60} while a recent systematic review showed that preoperative mouthwash can reduce the rate of SSI.⁶¹

Infectious disease specialists can assist in the care of patients with chronic mesh infections, mesh fistulas, panniculitis, and enterocutaneous fistulas. They can assist with pre and post-operative antibiotic regimens to maximize patient outcomes across single or multi-stage surgical interventions.^{15,62,63} Infectious disease, PCPs, or the surgical department can assess and “clear” reported penicillin allergies, which are as high as 22% in patients undergoing abdominal wall reconstruction.⁶⁴ Administration of appropriate beta-lactam surgical prophylaxis is associated with improved outcomes after plastic, orthopedic, and abdominal wall reconstruction when compared with non-beta lactam surgical site prophylaxis.^{65–67} Clearance of allergy can be done by a designated department such as infectious disease or primary care, or per the JAMA guidelines of testing.⁶⁸

Multimodal analgesia has been shown to improve patient outcomes. Discussion of perioperative pain control begins in the clinic and assists in management of patient expectations. Setting appropriate expectations of post-operative short-term and long-term pain is critical to success of AWR and patient satisfaction. As many patients' primary complaint is pain from their hernia, surgeons must spend ample time discussing the characteristics and nature of the pain to determine if AWR will resolve their symptoms. Immediate pre- and perioperative analgesia in coordination with anesthesia

staff may include ketamine, epidural anesthesia, intrathecal injections, transversus abdominis plane blocks with bupivacaine, and/or liposomal bupivacaine. Pre- and postoperative options include acetaminophen, NSAIDs, cyclooxygenase-2 inhibitors, and gabapentinoids.^{22,49,69–75} Postoperative pain control should be targeted at minimization of narcotics, with patients using opioids as an adjunct for breakthrough pain only.^{69,76}

Operation

There are key principles to follow in abdominal wall reconstruction, and the references in this section will provide a strong foundation for any surgeon looking to learn. These principles include preoperative optimization, durable and dynamic musculofascial reconstruction, careful attention to the skin and subcutaneous tissue, and postoperative management employing enhanced recovery after surgery protocols. Durable and dynamic reconstruction includes repairing good fascia to good fascia, reinforcing the fascial repair with mesh, ensuring proper mesh placement and fixation, and choosing the correct mesh. Careful tissue handling of skin and subcutaneous tissue minimizes undermining. Excising undermined and marginal skin and obliterating dead space are key.^{20,21} These principles hold true for both open and minimally invasive approaches.

Understanding these key principles sets a strong foundation for successful AWR. Coordination and collaboration among surgical specialists promotes focus on a discrete surgical goal, decreasing the cognitive load on each individual surgeon, and potentially improving efficiency. Higher procedural volumes have been correlated with improved patient outcomes and decreased overall costs.^{77,78}

Institutional support is necessary for success of the operation. It is vital that the surgeons have access to a variety of mesh as there is no one-size-fits-all option for patients.²¹ Specific equipment may vary per surgeon and institution, but consistency of practice and context will optimize technical outcomes. An operative staff familiar with surgeon preferences, operative setup and equipment, and the steps and potential difficulties of the procedure can be an invaluable asset to the efficiency and the success of a procedure. This team is prepared to anticipate the layout of the room, additional instruments to have available, and deep extubation to prevent coughing on a fresh reconstruction.

ERAS Protocol

Preoperative management and postoperative hospitalization require standardization of evidence-based recovery protocols. This is in the form of an enhanced recovery after surgery (ERAS) protocol. ERAS protocols include multimodal pain control, early diet and ambulation, specifics of

wound care, DVT prophylaxis, and respiratory exercises. Multimodal pain regimen may include neuraxial analgesia, transverse abdominis plane (TAP) blocks, scheduled non-narcotic NSAIDs, acetaminophen, and gabapentin. Other commonly instituted policies include the acceleration of intestinal recovery with diet and early mobilization.^{79–83}

The authors' institution follows an ERAS protocol that begins prior to arrival at the hospital. Patients are encouraged to take immunonutrition supplements and probiotics the week leading up to surgery.⁸⁴ They are also encouraged to consume at least one carbohydrate beverage the night before surgery.⁸⁵ Following surgery, the patient is started on a low carbohydrate and high protein diet to enhance wound healing.^{86,87} The patient participates in aggressive pulmonary toileting with incentive spirometry 10 times per hour while awake,⁸⁸ and ambulates two to four times on the day of the operation and five times per day each day after with the assistance of PT.⁷⁹ Medication management includes scheduled multimodal analgesia and PO oxycodone for moderate to severe pain.^{79–81} Prophylactic enoxaparin or subcutaneous heparin is administered,^{22,79,80} along with sequential compression devices on the calves when not ambulating.⁸⁹ A properly fitting abdominal binder is essential.⁹⁰ Drains are stripped every 2 hours or when 25% full.^{91,92}

To make sure these policies are being followed consistently requires a multidisciplinary approach with education and engagement of inpatient nursing staff, APP, house staff, and occupational and physical therapy. Establishing dedicated staff and hospital wards creates optimal outcomes by clustering care. Education and engagement may include the opportunity for continuing medical education credits, grand-rounds style presentations, and recordings and handouts for staff who have yet to attend. It is important to round frequently on these patients and maintain a presence in the area so that you can answer any questions that may arise, promote the following of your hospital's ERAS protocol, and maximize patient outcomes.

Postoperative Rehabilitation

Rehabilitation following these procedures is key to long-term success. Hernia patients require ongoing nutritional support to ensure healthy healing.⁸⁶ They may also require long-term wound care support in a home setting. Successful postoperative care can be supported with well-trained office staff including APPs. These providers can troubleshoot common wound care and vacuum therapy-related problems, as well as provide important patient care and face-to-face time for patients. Postoperative physical therapy and the promotion of continued ACH play a large role as patients return to normal levels of functioning. The Abdominal Core Surgery

Rehabilitation protocol provides a readily available program for the postoperative rehabilitation of patients.⁹³

Revenue, Research, and Continuous Quality Improvement

Building a center of ACH requires institutional investment in marketing and resources. Marketing may focus on areas of expertise and available resources. It may target local referring PCPs, general surgeons interested in referrals of complex patients, and online resources describing the specialists and services provided. Many patients with ACH deficiencies have been searching for answers for a long period of time and will find the center in a multitude of ways including their PCP or social media. The ability to refer to various internal specialists including other surgical specialties, infectious disease, nutrition, bariatrics, endocrine, and radiology will reinforce the collaborative effort of hernia repair, generate billable revenue, and improve patient outcomes, therefore continuing to provide a return on investment.

The clinic itself may be a neutral to negative cost, but the revenue it will generate with future surgeries, admissions, and referrals will greatly outweigh those possible losses. It is important to remember that although providing the best possible patient-centered care, members of this population commonly need continued care and possibly even further operations down the line, further increasing the revenue of the center. It is reasonable to assume some patients may begin following other specialists in your hospital system for their comorbidities if they have a positive experience with your center.

An ongoing review of resource utilization and approach to patient care with your team will help your center to be an efficient steward of resources within the hospital. Having experts within each field who are up to date with the best options for care allows for a collaborative approach to decreasing wasted resources on ineffective treatments and interventions, which can increase revenue. Standardization of preoperative, perioperative, and postoperative care can decrease the length of care, decrease complications, and improve patient outcomes. Ongoing review of new research, with correlation and application of evidence-based medicine, will include revision of advanced recovery protocols to maximize the benefit to the patient.

The effect of having surgeons and other team members focusing on what they are passionate about and specialize in is important. Surgeons will be motivated in the operating room knowing that they are focused on the portion of the case in which they possess the most expertise. By allowing surgeons and other team members to focus on what they excel at, patient satisfaction and outcomes will

be maximized by increasing the efficiency and quality of work. This potential increase in efficiency also allows for higher surgical turnover and reduced complications.⁹⁴

The integration of research and quality improvement in a specialty center provides multiple benefits to surgeons, institution, and patients. Efficiency and standardization of care allows for improved data capture by persons familiar with the surgical population. Collaboration among team members and combining different backgrounds and fields of expertise attracts industry and/or government financial sponsorship and may also be attractive to patients as it demonstrates a center that is on the cutting edge of the field. This research also promotes the use of the most up-to-date evidence to impact positive outcomes, which can also impact margin for the institution. Prospective following of patient short- and long-term outcomes is critical for continuous quality improvement. All members of the team should be involved in the quality improvement process with data gathering, analysis, feedback, and changes in practice as warranted. This institution has regularly utilized the Abdominal Core Health Quality Collaborative as a hernia-specific framework for this type of QI to occur.⁹⁵

Conclusions

Multidisciplinary centers for patients with complex medical issues are becoming the standard of care. Its benefits have been well-described for cancer, bariatric, orthopedic care, and complex wounds and include improvements in patient outcomes, decreases in overall morbidity and mortality, decreases in cost of care and economic burden, and increases in patient satisfaction.^{96–100}

The essential elements of a center for ACH include trained outpatient staff who assist with preoperative assessment and optimization. It also requires complex coordination of care. This varies from patient to patient, but commonly includes several surgical specialists, PCPs, anesthesiologists, nutritionists, and PTs involved in multiple parts of a patient's journey. Establishing referral patterns among specialists in their given field with an interest in this patient population will allow your center to provide the best potential outcomes for patients. It is key to protocolize as much of this process as possible. This includes preoperative, intraoperative, and post-operative care. These protocols are the foundation of optimal patient care, but it is important to apply a multidisciplinary approach to each patient individually. Lastly, by studying outcomes and continuously performing thorough research, your center can continue to improve individual practice and elevate surgical care on a national and international stage.

Author Contribution Austin P. Seaman, BS—drafting article, final approval.

Kathryn A. Schlosser, MD—drafting article, final approval.

Daniel Eiferman, MD, FACS—revising article, final approval.

Vimal K. Narula, MD, FACS—revising article, final approval.

Benjamin K. Poulouse, MD, FACS—revising article, final approval.

Jeffrey E. Janis, MD, FACS—concept development, oversight, revising article, final approval.

Declarations

Ethics Approval This study did not involve the use of any patient or animal data.

Conflict of Interest Dr. Janis receives royalties from Thieme and Springer Publishing. Dr. Poulouse receives research funding from BD Interventional and Advanced Medical Solutions; consulting fees from Ethicon; and salary support from the Abdominal Core Health Quality Collaborative. The remaining authors have nothing to disclose. No funding was received for this article.

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