



Current practices in complex abdominal wall reconstruction in the Americas: need for national guidelines?

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Received: 18 May 2021 / Accepted: 19 October 2021 / Published online: 16 November 2021
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Abstract

Background Component separation (CS) procedures have become an important part of surgeons' armamentarium. However, the exact criteria for training, procedure/mesh choice, as well as patient selection for CS remains undefined. Herein we aimed to identify trends in CS utilization between various cohorts of practicing surgeons.

Study design Members of the Americas Hernia Society were queried using an online survey. Responders were stratified according to their experience, practice profile (private vs academic, general vs hernia surgery), and volume (low (< 10/year) vs high) of CS procedures. We used Chi-squared tests to evaluate significant associations between surgeon characteristics and outcomes.

Results 275 responses with overwhelming male preponderance (88%) were collected. The two most common self-identifiers were "general" (66%) and "hernia" (28%) surgeon. PCS was the most commonly (67%) used type of CS; endoscopic ACS was least common (3%). Low-volume surgeons were more likely to utilize the ACS ($p < 0.05$). Only 7% of respondents learned PCS during their residency, as compared to 36% that use ACS. 65% felt 0–10 cases was sufficient to become proficient in their preferred technique. 10 cm-wide defect was the most common indication for CS; 23% used it for 5–8 cm defects. Self-identified "hernia" and high-volume surgeons were more likely to use synthetic mesh in the setting of previous wound infections and/or contaminated field ($p < 0.05$). More general/low-volume surgeons use biologic mesh. Contraindications to elective CS varied widely in the cohort, and 9.5% would repair poorly optimized patients electively. Severe morbid obesity was the most feared comorbidity to preclude CS.

Conclusion The use of CS varies widely between surgeons. In this cohort, we discovered that PCS was the most commonly used technique, especially by hernia/high-volume surgeons. There are differences in mesh utilization between high-volume and low-volume surgeons, specifically in contaminated fields. Despite its prevalence, CS training, indications/contraindications, and patient selection must be better defined.

Keywords Hernia · Trends · Posterior component separation · Mesh utilization

Ventral hernia repairs (VHR) continue to be one of the most frequently performed operations in the USA, with approximately 360,000 cases being done each year [1]. As such, a variety of surgical techniques exist to deal with the spectrum of hernia disorders. At the core remains the idea of recreating the natural anatomy of the abdominal wall, frequently with mesh reinforcement. Advances in both surgical

technique and mesh technology have occurred steadily since F.C. Usher first published on mesh repairs in the 1950's [2], allowing the current generation of hernia surgeons to tackle ever more complex cases in what can be considered the golden age of hernia surgery.

With such change in the field over the past two decades, surgeons now have at their disposal a greater option of both surgical technique and mesh material than ever before. And while the options for repair have grown, national guidelines on ventral hernia repair remain limited. Therefore, we aimed to assess current trends in complex abdominal wall reconstruction in order to better understand how surgeons' approach complex ventral hernia repair.

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Methods

IRB approval for this project was not required and therefore not obtained. Members of the Americas Hernia Society (AHS) were queried using an online survey that consisted of 37 questions (Addendum 1). AHS is a professional organization dedicated to advancing the science and treatment of hernia surgery, and members of AHS have a special focus on and interest in hernia surgery. The society consists of surgeons from North, Central, and South America. The questions were created by the main authors of this paper and focused on demographics, surgeon characteristics, practice characteristics, and preferences regarding surgical techniques in hernia surgery. SurveyMonkey™ was used to create the survey and the AHS e-mail server was used to send it out. Responders were stratified according to their experience, practice profile (private vs. academic, general vs. hernia surgery), volume (low (< 10/year) vs. high) of CS procedures, years out of training (2–5 vs. greater than 10), and whether or not they considered themselves “hernia experts”. The term “hernia expert” was self-defined. We used Chi-squared tests to evaluate significant associations between surgeon characteristics and preferences.

Results

A total of 275 responses were obtained. Demographic information is listed in Table 1. Eighty-eight (88%) of responders identified as male. The two most common self-identifiers were “general” (66%) and “hernia” (28%) surgeon. Fifty percent (50%) considered themselves hernia “experts,” with another 34% on the way to becoming one. The self-described “experts” performed component separation (CS) repairs on a weekly basis, which differentiated them from the non-experts. The majority were seasoned surgeons, with 62% of all respondents having been out of training for at least 10 years. More than half (55%) were affiliated with an academic practice. The majority of respondents were from the USA (83%) and this was not associated with the use of CS.

Posterior component separation (PCS) was the most commonly (67%) used type of CS; endoscopic anterior component separation (ACS) was least common (3%). Low-volume surgeons were more likely to utilize the ACS ($p < 0.05$, Table 2). Overall, only 7% of surgeons that use PCS learned the technique during their residency, as compared to 36% that use ACS. However, when broken down by age, 20% of the younger age cohort was exposed to PCS in residency, as compared to only 1% of those who have

Table 1 Demographic information

| | |
|--|----------|
| What is your gender? | N (%) |
| Male | 242 (88) |
| Female | 32 (12) |
| What is your age? | |
| 25 to 34 | 11 (4) |
| 35 to 44 | 104 (38) |
| 45 to 54 | 90 (33) |
| 55 to 64 | 55 (20) |
| > 65 | 15 (5) |
| What is your practice setting? | |
| Academic | 89 (32) |
| Private practice (solo) | 32 (12) |
| Private practice (group) | 89 (32) |
| Academic-affiliated private practice | 63 (23) |
| Military/uniformed services | 2 (1) |
| What Country do you work? | |
| United States of America | 229 (83) |
| Central and South America | 28 (10) |
| Other | 18 (7) |
| How long have you been in practice since graduating residency? | |
| < 5 years | 49 (18) |
| 5–10 years | 55 (20) |
| > 10 years | 170 (62) |
| Please choose how you would identify yourself: | |
| General surgeon | 179 (66) |
| Trauma/ACS surgeon | 15 (5) |
| Hernia surgeon | 75 (27) |
| Plastic surgeon | 4 (2) |

been practicing for greater than 10 years. The most common ways surgeons learned the PCS technique outside of residency was through industry-supported courses (31%) and self-taught methods such as videos on YouTube and social media platforms like International Hernia Collaboration (IHC) Facebook group (23%).

Overall, 65% of respondents felt that anywhere between 1 and 10 cases were enough to become proficient at their preferred technique. While a 10 cm-wide defect was the most common indication for a CS, 23% use CS for 5–8 cm defects and 5% use CS for defects as small as 5 cm. Only 43% of all respondents would use synthetic mesh in a clean-contaminated case. High-volume surgeons were more likely to use synthetic mesh in the setting of previous wound infections (66% vs. 34%, $p < 0.05$) and/or a clean-contaminated field (69% vs. 27%, $p < 0.05$) when compared to low-volume hernia surgeons (Table 2). Similar findings were shown between self-identified hernia surgeons and general surgeons for use of synthetic mesh in the setting of previous wound infection (68% vs. 41%, $p < 0.05$), clean-contaminated (62% vs. 36%, $p < 0.05$), and contaminated cases (17% vs. 5%, $p < 0.05$)

Table 2 Characteristics of high versus low volume surgeons

| Surgeon CS volume | Synthetic | <i>p</i> value | |
|---|-------------|--------------------|----------------|
| Which mesh would you use in the setting of previous wound infections? | | | |
| 1–5 times/year (Low volume) | 32 (34%) | < 0.5 | |
| 1–5 times/week (high volume) | 23 (66%) | | |
| Which mesh would you use in a clean-contaminated wound? | | | |
| 1–5 times/year (low volume) | 25 (27%) | < 0.5 | |
| 1–5 times/week (high volume) | 24 (69%) | | |
| Surgeon CS volume | Anterior CS | TAR (posterior CS) | <i>p</i> value |
| What is your preferred/most commonly used type of component separation technique? | | | |
| 1–5 times/year (low volume) | 30 (32%) | 47 (50%) | < 0.5 |
| 1–5 times/week (high volume) | 4 (11%) | 29 (83%) | < 0.5 |

CS component separation

Table 3 Characteristics of general versus hernia surgeons

| | Synthetic | <i>p</i> value |
|---|-----------|----------------|
| Which mesh would you use in the setting of previous wound infections? | | |
| General surgeon | 73 (41%) | < 0.05 |
| Hernia surgeon | 50 (68%) | |
| Which mesh would you use in a clean-contaminated wound? | | |
| General surgeon | 65 (36%) | < 0.05 |
| Hernia surgeon | 46 (62%) | |
| Which mesh would you use in a contaminated wound? | | |
| General surgeon | 9 (5%) | < 0.05 |
| Hernia surgeon | 13 (17%) | |

(Table 3). More general and low-volume surgeons would use a biologic mesh in any non-sterile scenarios.

Contraindications to elective CS varied widely in the cohort, but severe morbid obesity was the most feared comorbidity to preclude elective CS (43%). “Expert” hernia surgeons were more likely to offer elective repairs to higher BMI patients, and only 3% of all respondents would offer an elective hernia surgery to a patient with a BMI greater than 45.

Discussion

VHR continue to be one of the most frequently performed operations in the USA, at an annual cost of 3.2 billion dollars [1]. Nonetheless, many aspects of hernia surgery remain under debate, including but not limited to mesh type, surgical technique, and patient selection. With this survey, we aimed to identify trends in abdominal wall reconstruction among hernia surgeons in the AHS.

The overwhelming majority of members (67%) surveyed prefer posterior component separation PCS/transversus abdominis release (TAR) as their method for complex

abdominal wall reconstruction. Over the past 7 years, the TAR procedure has quickly gained popularity among hernia surgeons. We postulate two reasons for this. First, the TAR plane allows for a much larger mesh reinforcement of the visceral sac than the standard retro-rectus space used in traditional ACS [3]. Second, the TAR procedure significantly reduces wound morbidity by eliminating the need for large fascio-cutaneous flaps [3, 4]. While the benefits of the TAR procedure are significant, it is nonetheless a technically complicated procedure for which the training requirements have yet to be determined. Currently, only 7% of PCS users learned the TAR technique during their residency/fellowship. This most likely reflects the newness of the procedure; a significantly greater percentage of young surgeons were exposed to PCS in residency as opposed to the older surgeons surveyed. While the TAR procedure does offer tangible benefits, it remains a technically complicated procedure with the risk of a devastating denervation injury to the patient if not done correctly. Therefore, as the TAR procedure increases in popularity, it seems essential that teaching it should become a more integrated part of any general surgery and/or plastic surgery curriculum.

The use of synthetic mesh in clean-contaminated or contaminated fields is another debated topic within the hernia community. In our survey, only 43% of respondents would use a synthetic mesh in a clean-contaminated wound, and only 9% would do so in a contaminated field. When compared to general surgeons, self-identified hernia surgeons were almost twice as likely to use synthetic mesh in clean-contaminated cases (62% vs. 36%, $p < 0.05$), and three times as likely in contaminated fields (17% vs. 5%, $p < 0.05$). These numbers may reflect a changing paradigm in hernia surgery. Studies have shown that biologic mesh is inferior to synthetic mesh regarding long term recurrence rates, while synthetic mesh has shown to have acceptable rates of mesh infection and explantation in clean and clean-contaminated mesh [5–8]. These studies, combined with the availability of macroporous mesh [9–11] and a well-vascularized retromuscular plane provided by a posterior component separation, may be pushing higher volume hernia surgeons to expand their use parameters for synthetic mesh. It remains to be seen if this behavior is adopted in the more general surgery population.

The difference in synthetic mesh utilization between the two groups of surgeons is a critical finding from the survey. First, it reveals the lag between published data and implementation into practice. Second, it makes the case for dedicated hernia specialists and specialized hernia centers since there are obvious practice differences between high- and low-volume hernia surgeons. As with other specialties, high-volume hernia centers have been shown to have better outcomes regarding inguinal and ventral hernia repair [12, 13]. One can imagine that soon, complex hernia surgery will require referral to a specialty center with access to not only high-volume hernia surgeons but also pre-operative optimization programs.

Along those lines, it is not yet clear what makes somebody a “hernia expert”. Somewhat unexpectedly, 65% of all respondents felt that as few as 10 cases were enough to gain proficiency at their preferred reconstructive technique. This number seems low but not surprising, since there is currently no accepted definition of “hernia expert” or “hernia center” in the USA. To seek guidance, we could look at the European Hernia Society’s ACCESS group (Hernia Accreditation and Certification of Centers and Surgeons). In their 2019 publication, they defined a hernia expert as someone who “should intend to have experience of at least 300 hernia operations, including 100 ventral and incisional hernia repairs” [14]. Both the German and Italian Hernia Societies have a multi-tier hernia center accreditation process and the EHS has laid out expectations for both hernia specialists and centers regarding outcomes and research measures. The field of hernia surgery has changed drastically over the past decade and hernia specialists must now be able to offer patients increasingly complex open and robotic repairs. To ensure

patient safety and best outcomes, professional societies such as AHS need to provide specific accreditation parameters to define what a “hernia expert” and a “hernia center of excellence” is.

Conclusion

This study explored current thoughts and trends on abdominal wall reconstruction among diverse group of AHS members. TAR appears to be the most frequently used technique in abdominal wall reconstruction. Morbid obesity is the most feared co-morbidity precluding elective hernia repair. There are significant practice differences between self-identified hernia specialists and general surgeons that may reflect the need for better standardization and specialized hernia care. We believe our findings underscore the need for establishing national guidelines for both training and use of advanced surgical techniques in complex ventral hernia repair.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00464-021-08831-1>.

Funding None.

Declarations

Disclosures Dr. Yuri Novitsky reports grants and personal fees from Intuitive Surgical and personal fees from BD Interventional and Medtronic. Dr. Dina Podolsky is a paid speaker on behalf of Intuitive Surgical. Drs. Kelly Tunder, Omar Ghanem, and Emaad Iqbal have no conflict of interest and no financial ties to disclose.

References

1. Chattha A, Muste J, Patel A (2018) The impact of hospital volume on clinical and economic outcomes in ventral hernia repair: an analysis with national policy implications. *Hernia* 22(5):793–799
2. Usher FC, Hill JR, Ochsner JL (1959) Hernia repair with Marlex mesh. A comparison of techniques. *Surgery* 46:718–724
3. Novitsky YW, Elliott HL, Orenstein SB, Rosen MJ (2012) Transversus abdominis muscle release: a novel approach to posterior component separation during complex abdominal wall reconstruction. *Am J Surg* 204(5):709–716
4. Krpata DM, Blatnik JA, Novitsky YW, Rosen MJ (2012) Posterior and open anterior components separations: a comparative analysis. *Am J Surg* 203(3):318–322
5. Abdelfatah MM, Rostambeigi N, Podgaetz E et al (2015) Long-term outcomes (>5-year follow-up) with porcine acellular dermal matrix (Permacol™) in incisional hernias at risk for infection. *Hernia* 19:135–140
6. Rosen MJ, Krpata DM, Ermlich B, Blatnik JA (2013) A 5-year clinical experience with single-staged repairs of infected and contaminated abdominal wall defects utilizing biologic mesh. *Ann Surg* 257(6):991–996

7. Carbonell AM, Criss CN, Cobb WS, Novitsky YW, Rosen MJ (2013) Outcomes of synthetic mesh in contaminated ventral hernia repairs. *J Am Coll Surg* 217(6):991–998
8. Majumder A, Winder JS, Wen Y, Pauli EM, Belyansky I, Novitsky YW (2016) Comparative analysis of biologic versus synthetic mesh outcomes in contaminated hernia repairs. *Surgery* 160(4):828–838
9. Cevasco M, Itani KM (2012) Ventral hernia repair with synthetic, composite, and biologic mesh: characteristics, indications, and infection profile. *Surg Infect (Larchmt)* 13(4):209–215
10. Lake SP, Ray S, Zihni AM, Thompson DM Jr., Gluckstein J, Deeken CR (2015) Pore size and pore shape—but not mesh density—alter the mechanical strength of tissue ingrowth and host tissue response to synthetic mesh materials in a porcine model of ventral hernia repair. *J Mech Behav Biomed Mater* 42:186–197
11. Majumder A, Gao Y, Sadava EE, Anderson JM, Novitsky YW (2016) Cell-coating affects tissue integration of synthetic and biologic meshes: comparative analysis of the onlay and underlay mesh positioning in rats. *Surg Endosc* 30(10):4445–4453
12. Maneck M, Köckerling F, Fahlenbrach C, Heidecke CD, Heller G, Meyer HJ, Rolle U, Schuler E, Waibel B, Jeschke E, Günster C (2020) Hospital volume and outcome in inguinal hernia repair: analysis of routine data of 133,449 patients. *Hernia* 24(4):747–757
13. Christophersen C, Fonnes S, Andresen K, Rosenberg J (2021) Lower recurrence rate after groin and primary ventral hernia repair performed by high-volume surgeons: a systematic review. *Hernia*. <https://doi.org/10.1007/s10029-020-02359-4>
14. Köckerling F, Sheen AJ, Berrevoet F, Campanelli G, Cucurullo D, Fortelny R, Friis-Andersen H, Gillion JF, Gorjanc J, Kopelman D, Lopez-Cano M, Morales-Conde S, Österberg J, Reinhold W, Simmermacher RKJ, Smietanski M, Weyhe D, Simons MP (2019) Accreditation and certification requirements for hernia centers and surgeons: the ACCESS project. *Hernia* 23(2):185–203

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