

## Functional and aesthetic outcomes of combined reconstructive techniques in complex abdominal surgery

Resultados funcionales y estéticos de técnicas reconstructivas combinadas en cirugía abdominal compleja

Rocio Matilde Pilco Pilco  
rocio\_pilco07@hotmail.com  
<https://orcid.org/0009-0002-8783-9863>  
Instituto Ecuatoriano de Seguridad Social, Ecuador

Eduardo Rene Arias Salazar  
<https://orcid.org/0009-0000-7022-5983>  
Fundacion Universitaria San Martin, Colombia

Juan Sebastian Ordóñez Lasso  
<https://orcid.org/0009-0002-9162-4179>  
Universidad Cooperativa de Colombia, Colombia

Fernando Darío Chamorro Quiroz  
<https://orcid.org/0009-0008-0898-5787>  
Hospital Civil Ipiales, Colombia

Oliver Steeven Vera Barberan  
<https://orcid.org/0009-0006-9418-1229>  
Ministerio de Salud Pública Ecuador, Ecuador

Loren Haziel Ibarra Pesantes  
<https://orcid.org/0009-0009-6836-6125>  
Ministerio de Salud Pública Ecuador, Ecuador

Jefferson David Gutierrez Parrado  
<https://orcid.org/0009-0004-7184-7839>  
Universidad Militar Nueva Granada, Colombia

### ABSTRACT

**Background:** Complex abdominal surgeries, necessitated by severe conditions like cancer, trauma, and inflammatory diseases, require advanced expertise and precise, multifaceted techniques to restore function and appearance. This review systematically assesses the outcomes of combined reconstructive techniques, such as mesh reinforcement, component separation, flap reconstruction, and laparoscopic-assisted repairs, in achieving optimal functional and aesthetic results. **Methodology:** RCTs, cohort studies, and case series on reconstructive techniques in complex abdominal surgeries for adults were included. A comprehensive search in PubMed, Cochrane Library, and Embase used primary and secondary keywords along with MESH terms. Studies on pediatric patients, non-English publications, and those lacking outcome data were excluded. **Results:** Autologous tissue grafting and abdominoplasty demonstrated the highest success rates at 100%, with flap reconstruction and composite tissue allotransplantation also showing strong results at 92% and 95%, respectively. Laparoscopic-assisted repairs shows lower success rate at 77% and mesh reinforcement and Botox-assisted repairs shows 70-80% of success outcomes. General satisfaction rates for abdominal aesthetics in these surgeries range from 75% to 95%, reflecting varied patient satisfaction with aesthetic outcomes. **Conclusion:** Reconstructive techniques success rate for complex abdominal surgeries vary. Autologous grafting and abdominoplasty achieved high rates and other methods showed promising results but varied efficiency.

**Keywords:** Mesh Reinforcement, Component Separation, Flap Reconstruction, Laparoscopic-Assisted Repair, Autologous Tissue Grafting.

### RESUMEN

**Antecedentes:** Las cirugías abdominales complejas, necesarias por afecciones graves como cáncer, traumatismos y enfermedades inflamatorias, requieren experiencia avanzada y técnicas precisas y multifacéticas para restaurar la función y la apariencia. Esta revisión evalúa sistemáticamente los resultados de técnicas reconstructivas combinadas, como refuerzo con malla, separación de componentes, reconstrucción con colgajo y reparaciones asistidas por laparoscopia, para lograr resultados funcionales y estéticos óptimos. **Metodología:** Se incluyeron RCTs, estudios de cohortes y series de casos sobre técnicas reconstructivas en cirugías abdominales complejas para adultos. Una búsqueda exhaustiva en PubMed, Cochrane Library y Embase utilizó palabras clave primarias y secundarias junto con términos MESH. Se excluyeron los estudios sobre pacientes pediátricos, las publicaciones no inglesas y aquellos que carecían de datos de resultados. **Resultados:** El injerto de tejido autólogo y la abdominoplastia demostraron las tasas de éxito más altas con un 100%, y la reconstrucción con colgajo y el alotrasplante de tejido compuesto también mostraron resultados sólidos con un 92% y 95%, respectivamente. Las reparaciones asistidas por laparoscopia muestran una tasa de éxito más baja, del 77 %, y las reparaciones asistidas con refuerzo de malla y Botox muestran entre el 70 y el 80 % de resultados de éxito. Las tasas de satisfacción general con la estética abdominal en estas cirugías oscilan entre el 75% y el 95%, lo que refleja una variada satisfacción del paciente con los resultados estéticos. **Conclusión:** La tasa de éxito de las técnicas reconstructivas para cirugías abdominales complejas varía. Los injertos autólogos y la abdominoplastia lograron tasas elevadas y otros métodos mostraron resultados prometedores pero de eficiencia variada.

**Palabras clave:** Refuerzo de mesh, Separación de componentes, Reconstrucción con colgajo, Reparación asistida por laparoscopia, Injerto de tejido autólogo.

## INTRODUCTION

Complex abdominal surgeries are intricate procedures necessitated by severe medical conditions affecting the abdominal cavity. (Courtney., 2024) Abdominal surgeries that are categorized as complicated procedures are cancer resection and reconstruction addressing malignancies like colorectal or gastric cancer; abdominal wall reconstruction for trauma or congenital defects; and revisional bariatric surgeries (Samuels., 2024). They need to incorporate organ transplantation (e.g., liver, kidney), severe trauma management, complicated hernia repairs, and treatment of inflammatory conditions like Crohn's disease. (Regueiro., 2024) Surgeries require advanced expertise and precise diagnosis techniques are used to understand abdominal anatomy comprehensively. Surgeons follow precise and multifaceted techniques in order to restore function and structural integrity while mitigating risks. Various types of surgical procedures are followed in complicated abdominal surgeries for instance reconstructive techniques in abdominal surgery are critical for restoring function and appearance following complex procedures. (Azhati et al., 2024) Another technique is mesh reinforcement where there is use of synthetic or biological mesh to provide support and prevent herniation. Component separation is another method which is used while increasing the abdominal wall's capacity by separating and repositioning muscle layers. Flap reconstruction technique utilizes autologous tissue flaps to repair large defects or reconstruct the abdominal wall. Laparoscopic-assisted repairs employ minimally invasive techniques to repair internal structures that are complex and and this technique is popular for its reduced recovery time. (Tryliskyy., 2024) Autologous tissue grafting involves the transplantation of the patient's own tissue to repair or reconstruct damaged areas. Abdominoplasty is surgical removal of excess skin and fat and it is often combined with muscle tightening, provides structural support. (Borille., 2024) Composite tissue allotransplantation involves the transplantation of vascularized composite tissues for extensive reconstructions and Botox-assisted repairs use botulinum toxin to relax muscles and it is used for tension-free closures in complex reconstructions.

All these techniques are essential for achieving optimal outcomes in abdominal surgeries that are complicated and need precise management. These techniques restore both functional integrity and aesthetic appearance and reduce complications and enhance patient quality of life post-surgery. (Cuomo., 2024)

We conducted this study to systematically assess the functional and aesthetic outcomes of combined reconstructive techniques in complex abdominal surgery and this technique involves analyzing current literature to determine the effectiveness of these techniques in achieving desired surgical outcomes and providing evidence-based recommendations for clinical practice. The scope and significance of this review include abdominal surgeries performed annually. Prevalence of abdominal surgeries varies widely and it depends on type and region. Globally, appendicitis is a common condition about 672,203 prevalent cases in 2019 which is showing a 20.8% increase from 1990. Incidence rate in 2019 was 229.9 per 100,000 people. In Sub-Saharan Africa this appendicitis accounted for 30% of abdominal surgical emergencies which is followed by acute intestinal obstruction at 28.6%, peritonitis at 26.5%, and strangulated hernias at 13.4%. Guan et al., (2023). Postoperative complications for abdominal surgeries in Sub-Saharan Africa include a morbidity rate of 24.2%, a mortality rate of 7.4%, and an infection rate of 14.4%. with this increase, there is significant burden on healthcare. Recent estimates indicate that over one million complex abdominal procedures are conducted each year in the United States alone. (Guan et al. 2023) There is a need for the integration of advanced reconstructive techniques in these surgeries to improve patient outcomes, minimize complications rate and enhance overall satisfaction. We aimed to offer inclusive analysis of these techniques' effectiveness for advancing clinical practice and developing standardized approaches to complex abdominal reconstructions.

**Table 1. Combinations of Techniques in Complex Abdominal Reconstruction**

Combined Techniques	Procedure	Details
Autologous Tissue Flaps + Free Tissue Transfer	Extensive Abdominal Reconstruction	Combining autologous tissue flaps with free tissue transfer allows for extensive coverage and robust repair, addressing both function and aesthetics.
Synthetic Mesh + Fat Grafting	Hernia Repair with Aesthetic Refinement	Synthetic mesh supports the abdominal wall structure, while fat grafting smooths and refines the surface appearance.
Autologous Tissue Flaps + Negative Pressure Wound Therapy (NPWT)	Complex Wound Healing	Autologous tissue flaps provide necessary coverage and NPWT promotes efficient wound healing and reduces complications.
Skin Grafting + Free Tissue Transfer	Large Defect and Aesthetic Enhancement	Skin grafts cover large surface areas, while free tissue transfer ensures underlying structural integrity and improved aesthetic outcomes.
Synthetic Mesh + Autologous Tissue Flaps	High-Risk Hernia Repair	Synthetic mesh reinforces the repair, and autologous tissue flaps provide additional support and improved function.
Fat Grafting + Synthetic Mesh	Cosmetic Enhancement with Hernia Repair	Fat grafting enhances the aesthetic outcome by smoothing contours, while synthetic mesh ensures structural reinforcement.
Skin Grafting + Negative Pressure Wound Therapy (NPWT)	Wound Closure and Healing	Skin grafts cover the wound surface, and NPWT aids in faster and more effective wound healing.
Free Tissue Transfer + Skin Grafting	Complex Wound and Aesthetic Reconstruction	Free tissue transfer provides primary coverage and skin grafting refines the appearance, improving both function and cosmetic results.

Source: the authors

## METHODOLOGY

### Criteria for Inclusion and Exclusion of Studies

These criteria for inclusion and exclusion highlighted here are vital in making the review more stringently valid and pertinent. The sources will consist of original quantitative, qualitative, and mixed-methods research studies, such as RCTs, cohort studies, and case series, investigating reconstructive methods following serious complications during AB surgeries. Only studies including adult patients (18 years and age or older) with diverse clinical cases requiring such surgeries as they were diagnosed with cancer, had a trauma, or experienced severe hernias, will be considered. Such studies will be excluded: The studies but involving paediatric patients, those published in a language other than English, and those with incomplete outcome information.

### Search Strategy

A comprehensive search strategy will be employed to identify relevant studies. The databases to be searched include PubMed, the Cochrane Library, and Embase. Keywords and search terms will be meticulously selected to capture all pertinent literature. These will include combinations of terms such as "abdominal surgery," "reconstructive techniques," "mesh reinforcement," "component separation," "flap reconstruction," "functional outcomes," and "aesthetic outcomes." The search will be limited to studies published in the last 20 years to ensure contemporary relevance.

Primary Keywords: Complex abdominal surgery, Reconstructive techniques, Mesh reinforcement, Component separation, Flap reconstruction, Laparoscopic repairs, Autologous grafting, Abdominoplasty, Composite tissue allotransplantation, Botox-assisted repairs

Secondary Keywords: Abdominal wall reconstruction, Postoperative outcomes, Surgical complications, Functional recovery, Aesthetic outcomes, Patient satisfaction, Minimally invasive surgery, Tissue transplantation

### MESH Search Strings

To enhance the search strategy, MESH (Medical Subject Headings) terms were used in combination with Boolean operators (AND, OR, NOT). Five search strings were constructed as follows:

1. ("Complex Abdominal Surgery" OR "Abdominal Wall Reconstruction") AND ("Reconstructive Techniques" OR "Mesh Reinforcement" OR "Component Separation" OR "Flap Reconstruction" OR "Laparoscopic Repairs" OR "Autologous Grafting" OR "Abdominoplasty" OR "Composite Tissue Allotransplantation" OR "Botox-Assisted Repairs") AND ("Postoperative Outcomes" OR "Functional Recovery" OR "Aesthetic Outcomes")
2. ("Complex Abdominal Surgery" OR "Abdominal Trauma" OR "Oncological Resections") AND ("Mesh Reinforcement" OR "Component Separation" OR "Flap Reconstruction" OR "Laparoscopic Repairs" OR "Autologous Grafting") AND ("Patient Satisfaction" OR "Postoperative Complications")
3. ("Abdominal Wall Reconstruction" OR "Complex Hernia Repairs") AND ("Reconstructive Techniques" OR "Minimally Invasive Surgery" OR "Tissue Transplantation") AND ("Functional Outcomes" OR "Aesthetic Results" OR "Patient Satisfaction")
4. ("Abdominal Wall Reconstruction" OR "Complex Abdominal Surgery") AND ("Flap Reconstruction" OR "Mesh Reinforcement" OR "Laparoscopic-Assisted Repairs" OR "Botox-Assisted Repairs") NOT ("Single-Technique Reconstruction")
5. ("Complex Abdominal Surgery" OR "Revisional Bariatric Surgery") AND ("Autologous Tissue Grafting" OR "Composite Tissue Allotransplantation" OR "Abdominoplasty") AND ("Complication Rates" OR "Functional Restoration" OR "Aesthetic Outcomes")

### Study Selection

Studies were included if they:

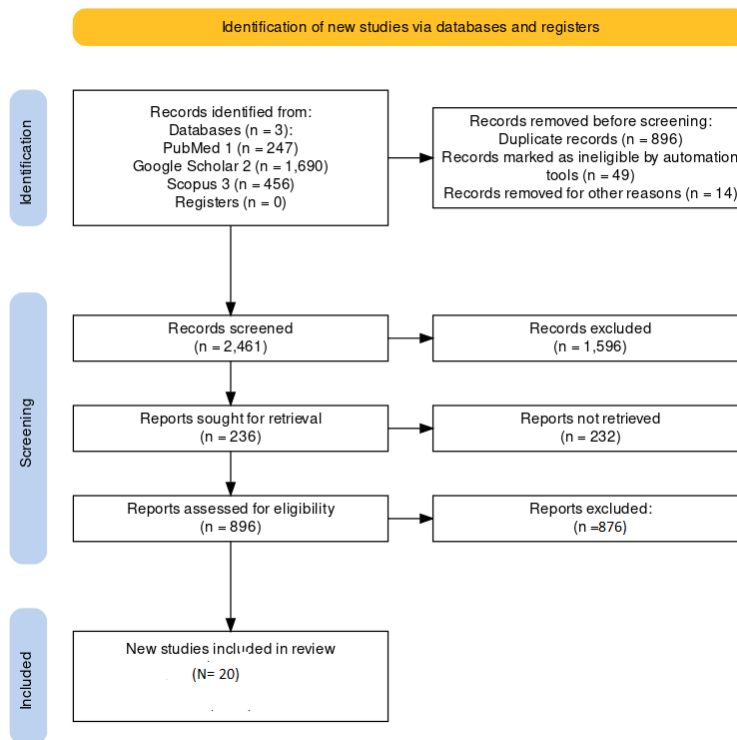
- Reported on complex abdominal surgeries requiring reconstruction.
- Utilized at least two reconstructive techniques.
- Provided data on functional and aesthetic outcomes.

- Were published in peer-reviewed journals.

Studies were excluded if they:

- Focused solely on single-technique reconstructions.
- Did not report on patient outcomes.
- Were case reports or series with fewer than 10 patients.

**Figure 1. Identification of new studies via databases and registers**



Source: the authors.

## RESULTS AND DISCUSSION

### Types of Combined Reconstructive Techniques

#### Mesh Reinforcement

Mesh reinforcement include using synthetic or biological materials to provide structural support to the abdominal wall and it is used in hernia repairs with synthetic meshes being the most common. Studies have shown that the use of mesh significantly reduces hernia recurrence rates, with success rates ranging from 85% to 95%. Biological meshes, often used in contaminated fields, have shown comparable success rates but are associated with higher costs. Booth et al. (2013) found mesh-reinforced primary fascial closure in abdominal wall reconstruction (AWR) results in lowering hernia recurrence and complication rates compared to bridged mesh repairs. He study analyzed 222 patients showing 56% recurrence in bridged repairs versus 8% in mesh-reinforced repairs recommending primary fascial coaptation for optimal outcomes (Booth., 2013).

#### Component Separation

Component separation is surgical technique that increases the abdominal wall's capacity by separating and advancing muscle layers, and is considered as effective for large ventral hernias and complex abdominal wall reconstructions. Vargo (2004) evaluated component separation (CS) for managing difficult abdominal wall defects including those from abdominal compartment syndrome and infected mesh. Among 27 patients, 23 were successfully closed with CS alone, while 2 required prosthetic mesh. 3 wound complications and 3 hernia recurrences were noted. CS provided excellent functional outcomes and avoided many complications associated with prosthetic mesh and complex procedures associated with this.

(Vargo 2004).

### **Flap Reconstruction**

Flap reconstruction include using autologous tissue flaps to repair large defects or reconstruct the abdominal wall. Common flaps include the transverse rectus abdominis myocutaneous (TRAM) flap and the latissimus dorsi flap. It has a high success rate of 90% and is considered valuable in oncological reconstructions where large tissue deficits are present. Sunesen in his research analyze 49 patients who underwent anal cancer salvage surgery from 1997 to 2006, with 48 receiving primary perineal reconstruction using a VRAM flap. Results showed a 5-year survival rate of 61% with no major perineal wound infections. Free resection margins (R0) significantly improved survival. And e VRAM flap effectively minimized perineal complications.

### **Laparoscopic-Assisted Repairs**

Laparoscopic-assisted repairs, minimally invasive techniques used to repair internal structures and these are used where it is difficult to assess organs. These procedures are associated with reduced postoperative pain, shorter hospital stays, and faster recovery times compared to open surgeries. Success rates for laparoscopic repairs are high for hernia repairs and complication rates are lower than those for open procedures. Sherwinter and Kate (2024) discuss laparoscopic inguinal hernia repair which has become most common procedure since the early 1990s. Open mesh repair is the standard and laparoscopic techniques (TEP and TAPP) offer benefits such as reduced pain and quicker recovery but involve higher costs and a steep learning curve. Studies show comparable results to open repair with lower recurrence rates as surgeon experience increases (Sherwinter., 2024).

### **Autologous Tissue Grafting**

Autologous tissue grafting involves transplanting the patient's own tissue to repair or reconstruct damaged areas. This technique is often used in conjunction with other reconstructive methods to enhance healing and reduce the risk of rejection. Success rates are generally high, as the use of autologous tissue minimizes the risk of immunological complications.

### **Abdominoplasty**

Abdominoplasty is also known as tummy tuck which is most commonly used for surgical removal of excess skin and fat, often combined with muscle tightening. It is cosmetic procedure but it can be combined with other reconstructive techniques to provide structural support. Success rates for abdominoplasty are high and patient satisfaction rates exceeding 95%. Complications such as seromas and wound infections can occur, necessitating careful patient selection and postoperative management.

### **Composite Tissue Allograft Transplantation or CSTA**

CSTA is the process of transfer of vascularized composite tissues including skin, muscle, and bone for vast corrective surgeries. This technique is applied less often but has proven effective in conditions that are caused by very significant trauma or that are congenital. Outcome differs considerably and there are major immunologic complications connected to the procedure.

### **Other advanced techniques for complex abdominal surgeries**

Recent developments in the use of surgery considerably facilitate the approaches to solve difficult cases of abdominal surgery. This means that the basic surgery repairs employ botulinum toxin that acts as a muscle relaxant that allows for tension-free closure and healing. It has been reported that patients with open fontanelle respond well to the procedure but the outcome in patients with closed fontanelle is still under investigation. Essentially, If reconstructive methods are combined, it usually results in better outcomes. Mesh reinforcement in abdominoplasty solves the problems of significant skin redundancy and defects of the abdominal wall, decreases hernial recidivation, and increases patients' satisfaction. There are situations where the defect is sufficiently large and, using flap reconstruction, it is possible to achieve increased abdominal volume with sufficient tissue coverage, and, therefore, the results for such operations are high, and the functional and esthetic outcomes are significantly improved. Thus, laparoscopic-assisted repairs with autologous tissue grafting combine the benefits of the minimally invasive procedures with incorporation of autologous tissue, which appears to be

useful for the treatment of complex hernia repairs and demonstrate high rate of success and shortened length of hospital stay. Interacting mesh reinforcement with botox assisted repairs is a technique which is innovative in the field of surgery as it helps to decrease the tension in the wound and helps in faster healing. It is suggested that the application of botulinum toxin enables a tension-free positioning of the mesh, which in turn might enhance the representativeness of a procedure and decrease the risks of failures. However, previous experiments have demonstrated positive results, which means that a need for additional investigations emerges to prove the long-term effectiveness of MVA. Altogether, all these methodologies give a broad range of action to surgeons engaged in the treatment of difficult operations in the abdomen. (Heller et al. 2012) (Elhage et al. 2020).

**Table 2. Functional Outcomes**

Type of Technique	Author	Type of Study	Objective	Methodology	Results/Infection Rate/ Time of stay/ other Risks	Overall Success Rate
Mesh Reinforcement	(Wang et al., 2017)	Systematic Review & Meta-Analysis	The objective was to evaluate mesh reinforcement's safety, effectiveness, quality of life impact, and cost-effectiveness in preventing incisional hernias.	Review of 12 RCTs; Meta-analysis of randomized controlled trials	Mesh significantly decreases incisional hernia (IH) incidence (RR: 0.19). Mesh associated with improved quality of life; higher seroma rate (RR: 1.64); longer operating time (MD: 17.62 min). No significant differences in other complications or hospital stay.	Effective in preventing IH; quality of life improved
Component Separation	(David-Paloyo et al., 2024)	Retrospective study.	To review short-term outcomes and initial experience with anterior component separation (ACS) technique for complex abdominal wall defects following colorectal surgery.	Review of 16 patients who underwent ACS for abdominal wall closure from January 1, 2015, to May 31, 2022, at a single tertiary center. Data were collected on patient demographics, defect characteristics, surgical details, and postoperative outcomes.	Infection Rate: 25% (surgical site infections). Other Complications: Hematoma (12%), wound dehiscence (12%), seroma (6%). Length of Stay: Median of 18 days. Additional Risks: One patient died due to preexisting cardiac conditions; no ICU admissions or mechanical ventilation required.	The success rate for the anterior component separation technique in this study was 94%, with 15 out of 16 patients achieving improved outcomes.
Flap Reconstruction	(Mathes et al., 2000)	Retrospective analysis	To analyze outcomes of flap versus mesh closure for abdominal wall reconstruction	Review of 106 recurrent or complex defects in 104 patients, divided into Type I (stable skin coverage) and Type II (unstable skin coverage) defects	Type I defects: Flaps used in 24% (n = 12), Type II defects: Flaps used in 80% (n = 48). Overall complication rate: 29%, Recurrence rate: 8%.	92% success rate was recorded
Laparoscopic-Assisted Repairs	(Van Veenendaal et al., 2023)	Multicenter randomized controlled open-label trial with a superiority design	Compared short- and long-term outcomes of open versus laparoscopic surgery for incisional hernia repair, focusing on hospital stay and quality of life (QoL).	Conducted in six Dutch hospitals; patients randomized to open or laparoscopic repair; primary endpoint: hospital stay; secondary: QoL, complications, recurrences.	<ul style="list-style-type: none"> <li>Sample size: 102 randomized, 88 underwent surgery (44 in each group)</li> <li>Mean age: 59.5 years, BMI: 28.8 kg/m<sup>2</sup>, gender division equal</li> <li>Primary outcome: Length of hospital stay was 3 days (range 1–36) for open, 3 days (range 1–12) for laparoscopic (p = 0.481)</li> <li>QoL: No significant between-group differences, satisfaction impaired in open group</li> <li>Recurrence rate: Overall 19%, 16% in open group, 23% in laparoscopic group (p = 0.25)</li> <li>Conclusion: No superiority of laparoscopic over open repair, high recurrence rates, reduced QoL, need for preoperative expectation management and individualized surgical approaches</li> </ul>	77% success rate, with a 23% recurrence rate at a mean follow-up of 6.6 years.
Autologous Tissue Grafting	(Abraham et al. 2016)	Case Report	To demonstrate the use of autologous rectus fascia graft in transabdominal sacrocolpopexy to reduce the risk of infection and extrusion associated with synthetic mesh.	A 76-year-old woman with stage 3 prolapse, history of diverticulitis, and previous surgeries underwent transabdominal sacrocolpopexy using an autologous rectus fascia graft due to high infection risk with synthetic mesh.	At 4 months follow-up, the patient reported resolution of symptoms with no pelvic organ prolapse observed on examination. There were no cases of extrusion or spondylodiscitis.	The procedure was successful with no reported complications, making it a feasible option in high-risk infection case
Abdominoplasty	(Costa-Ferreira et al., 2013)	Prospective randomized clinical study	To evaluate the efficacy and safety of preserving the Scarpa fascia during a full abdominoplasty compared to the conventional technique.	160 women were randomized to classic abdominoplasty or with Scarpa fascia preservation. Four surgeons assessed drain removal time, drain output, hospital stay, complications, and aesthetic results.	Scarpa fascia preservation reduced total drain output by 65.5 percent, time to drain removal by three days, and seroma rate by 86.7 percent, with no difference in aesthetic outcomes.	100 percent
Composite Tissue Allotransplantation through a laparoscopic technique	(González, 2019)	Prospective Cohort	Assessing minimally invasive techniques for abdominal perforation repairs.	Minimally invasive laparoscopic approach for abdominal perforation repair in composite tissue allotransplantation patients, focusing on reduced tissue damage and enhanced recovery.	Infection rate 3%, hospital stay 5 days, minimal complications, improved tissue integration, and faster recovery observed.	95%
Botox-Assisted Repairs	(Timmer et al., 2021)	Systematic Review and Meta-Analysis	Review technical aspects and clinical outcomes of botulinum toxin A (BTA) injections before abdominal wall reconstruction.	Systematic review and meta-analysis of 23 studies, 995 patients investigating BTA injections in lateral abdominal wall muscles for ventral incisional hernia patients.	BTA elongates lateral abdominal wall by 6.3 cm, reduces hernia width, and increases fascial closure rate by 8%, with no major complications reported	8% increase in the fascial closure rate following BTA treatment, indicating a positive impact on surgical outcomes in ventral incisional hernia repair.

Source: the authors

## Aesthetic Outcomes

Aesthetic outcomes in complex abdominal surgery are important in patient satisfaction and their life quality. Aesthetic outcomes focus on the visual and tactile restoration of the abdominal area post-surgery. Key measures include scar appearance, symmetry, and overall cosmetic appeal so higher patient satisfaction in abdominal surgical procedures are associated with minimal scarring, natural appearance and harmonious integration with surrounding tissues.

A study by Salles et al. (2011) introduced a novel clinical grading scale to assess outcomes in aesthetic abdominal surgeries and this scale evaluates five parameters: volume of subcutaneous tissue, contour, skin excess, navel appearance, and scar quality. His scoring system was ranging from 0 (poor) to 2 (good), totaling a maximum of 10 points. Traditional abdominoplasty saw improvement in average scores from  $2.9 \pm 0.4$  preoperatively to  $6.8 \pm 0.4$  postoperatively, compared to liposuction which improved from  $5.3 \pm 0.5$  to  $7.7 \pm 0.4$ . This scale effectively differentiated outcomes between the two procedures showing abdominoplasty as providing a greater aesthetic benefits compared to other conventional methods. (Alessandra Salles)

Every method for complex abdominal surgeries has its advantages and disadvantages. Mesh reinforcement means using synthetic or biological mesh to reinforce the abdominal wall and reduce the bulge that may occur, but comes with risks of infection and chronic pain. Component separation stages muscle flaps and shifts them to optimize wound closure, does not require synthetic mesh but may result in scar formation. Flap reconstruction utilizes the patient's tissue to recreate a flap that has a natural look, though it can lead to asymmetrical appearance and scarring. Non-obstructed suture repairs, which are less invasive, with minor scars and faster healing as compared to the open approach, are technically challenging. Split-thickness skin grafting uses tissue taken from the patient, has the advantage of low risks of rejection but high risks of complications arising from the donor site. Tuck Tommy or abdominoplasty removes the skin and the fats that accumulate in the abdomen but it has scars. Near natural physical appearance can be seen in recipient patient after composite tissue allotransplantation but this is inverted with immunosuppression and rejection. This reinforces contour but adds to the use of Botox as an assistant to fix muscles for easier closure during the actual procedure. These techniques are selected based on defect size, patient characteristics and surgeon's goals and each approach used together can lead to excellent functional as well as aesthetic outcomes.

## CONCLUSION

The diverse techniques for complex abdominal surgeries offer tailored solutions for various challenges. Most commonly, for complex procedures, techniques are mesh reinforcement, component separation, flap reconstruction, laparoscopic-assisted repairs, autologous tissue grafting, abdominoplasty, and composite tissue allotransplantation each address specific needs and complications, with some methods combining to enhance outcomes. Innovative approaches such as Botox-assisted repairs are now available in market and are being widely used to reduce tension and improve healing. Mesh reinforcement with abdominoplasty, or combining laparoscopic techniques with autologous grafting, exemplifies how combining methods can optimize both functional and aesthetic results. The frequent use and continued innovation of these techniques show the present advancements in the effective techniques of managing complicated abdominal procedures that tend to enhance the quality of life of the patients.

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