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Non-Inguinal Ventral Hernias: An Updated Review for Healthcare Providers

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Abstract

Ventral hernias, defined as non-inguinal and nonhiatal fascial defects in the abdominal wall, are a significant clinical concern, with approximately 350,000 repairs performed annually in the United States. These hernias can impair quality of life, lead to hospitalizations, and, in severe cases, result in mortality. The etiology includes congenital and acquired factors, with obesity, prior surgeries, and repetitive abdominal stress being major contributors. Surgical repair is the primary treatment, but recurrence and complications remain challenges.This review aims to provide an updated overview of the etiology, epidemiology, pathophysiology, diagnosis, and management of ventral hernias, emphasizing evidence-based strategies to improve outcomes and reduce complications. Also, the study focus on the critical role of anesthesiologists in the ventral hernia surgery and post-operative management. The review synthesizes current literature on ventral hernias, including classification systems, diagnostic approaches, surgical techniques, and postoperative care. It highlights the role of imaging, preoperative optimization, and the use of synthetic versus biologic meshes. The review also discusses the importance of multidisciplinary collaboration and patient education in enhancing outcomes.Ventral hernia repair outcomes vary based on surgical technique, patient factors, and hernia characteristics. Laparoscopic and robotic-assisted repairs are associated with lower recurrence rates and faster recovery compared to open techniques. Mesh use significantly reduces recurrence, but infection remains a catastrophic complication. Component separation techniques, such as transversus abdominis release (TAR), are effective for large hernias but are technically demanding. Parastomal hernias require specialized repair techniques, with prophylactic mesh placement reducing incidence.Ventral hernias are a complex surgical challenge requiring tailored approaches based on patient and hernia-specific factors. Advances in surgical techniques, mesh technology, and multidisciplinary care have improved outcomes, but recurrence and complications remain significant concerns. Continued research and adherence to evidence-based practices are essential to further enhance patient outcomes.

Keywords: *Ventral Hernia, Hernia Repair, Mesh, Laparoscopy, Component Separation, Parastomal Hernia, Recurrence, Complications.*

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Introduction

Ventral hernias, which refer to non-inguinal and nonhiatal fascial defects in the abdominal wall, represent a significant clinical concern within the field of general surgery. Approximately 350,000 surgical procedures are conducted annually to address these hernias, underscoring their prevalence and the demand for effective repair strategies. The management of abdominal wall defects through surgical intervention is a routine practice among general surgeons, particularly for patients who exhibit symptomatic hernias, possess an acceptable surgical risk profile, or face an increased likelihood of hernia-related complications. These hernias can substantially impair an individual's quality of life, often necessitating hospitalization and, in severe cases, leading to mortality. The clinical significance of ventral hernias is further emphasized by their potential to cause life-threatening complications if left untreated, highlighting the importance of timely and effective surgical intervention [1][2][3]. The decision to pursue surgical repair is typically guided by the presence of symptoms, the risk of complications such as incarceration or strangulation, and the overall health status of the patient. Symptomatic hernias, which may present pain, discomfort, or functional limitations, are a primary indication for surgery. Additionally, individuals at heightened risk of complications, such as those with large or rapidly progressing hernias, are often advised to undergo surgical correction to mitigate adverse outcomes. The impact of ventral hernias extends beyond physical health, as they can also contribute to psychological and social burdens, further diminishing the patient's overall well-being. Consequently, the repair of these defects is not only a medical necessity but also a means of improving the patient's holistic quality of life. The literature underscores the critical role of surgical intervention in managing ventral hernias, as evidenced by the substantial volume of procedures performed annually and the potential for severe outcomes if these conditions are inadequately addressed [1][2][3].

Etiology

The etiology of ventral hernias can be broadly classified into two primary categories: acquired and congenital. While the majority of ventral hernias encountered and treated by general surgeons are acquired, a subset of individuals may present with congenital hernias that persist from birth, often remaining untreated for extended periods before surgical intervention is sought. Acquired ventral hernias are frequently attributed to factors such as prior surgical procedures, which can result in incisional hernias, physical trauma to the abdominal region, or repetitive strain on inherently vulnerable areas of the abdominal wall. These anatomical weak points, which are predisposed to herniation, include the umbilicus, semilunar line, ostomy sites, bilateral inguinal regions, and the esophageal hiatus. Additionally, obesity plays a significant role in the development of ventral hernias, as excessive adipose tissue places sustained pressure on the abdominal fascia, leading to its gradual weakening. The cyclical process of weight gain and loss exacerbates this issue, further compromising the structural integrity of the abdominal wall and increasing the likelihood of herniation [4]. Congenital ventral hernias, though less common, are present from birth and may remain asymptomatic or undiagnosed for years. These hernias are often identified incidentally or when they become symptomatic, prompting surgical evaluation. In contrast, acquired hernias are more directly linked to external factors such as surgical incisions, which disrupt the abdominal wall's continuity, or traumatic injuries that weaken their structural support. Repetitive stress on the abdominal wall, whether from physical activity, chronic coughing, or heavy lifting, can also contribute to the development of hernias over time. The interplay between anatomical predispositions and external stressors underscores the multifactorial nature of ventral hernia etiology. Understanding these underlying causes is critical for both prevention and effective management, as addressing modifiable risk factors such as obesity and minimizing surgical or traumatic insults can significantly reduce the incidence of ventral hernias [4].

Epidemiology

The epidemiology of ventral hernias highlights their significant impact on healthcare systems, both in terms of prevalence and associated costs. In 2006 alone, approximately 348,000 ventral hernia repairs were performed in the United States, with the total estimated cost reaching $3.2 billion. This substantial financial burden is largely driven by the need for emergency repairs and the management of postoperative complications, which often require additional interventions and prolonged hospital stays. The economic

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implications of ventral hernia repairs underscore the importance of effective preventive measures and optimized surgical techniques to reduce the incidence of complications and associated costs. Postoperative hernia development remains a notable concern, with varying rates depending on the type of surgical incision. For instance, patients undergoing midline laparotomy face an approximately 10% risk of developing a hernia, while those with transverse muscle-splitting incisions have a lower risk of around 5%. In contrast, laparoscopic repairs are associated with the lowest risk, at less than 1%, highlighting the advantages of minimally invasive techniques in reducing postoperative complications [5][6]. The high incidence of ventral hernias and their associated costs reflect the broader challenges within surgical practice and healthcare delivery. Emergency repairs, often necessitated by complications such as incarceration or strangulation, contribute disproportionately to the financial burden, as these procedures typically involve more complex interventions and longer recovery periods. Additionally, the risk of hernia recurrence or development following initial surgery remains a persistent issue, particularly in cases involving open surgical techniques. These epidemiological insights emphasize the need for continued advancements in surgical methods, such as the adoption of laparoscopic approaches, which have demonstrated superior outcomes in terms of reduced hernia recurrence and lower complication rates. Furthermore, understanding the risk factors associated with postoperative hernia formation can inform clinical decision-making and improve patient outcomes, ultimately alleviating the economic and clinical burden of ventral hernias on healthcare systems [5][6].

Pathophysiology

The pathophysiology of ventral hernias is intricately linked to the anatomical and functional integrity of the anterior abdominal wall, which is composed of multiple layers, including the skin, subcutaneous fat, fascia, muscle, and peritoneum. The arrangement of these layers varies depending on the specific location of the abdominal wall being examined. A key anatomical landmark is the arcuate line, an imaginary horizontal line located approximately midway between the umbilicus and the pubic symphysis. Above the arcuate line, the rectus abdominis muscle is enveloped by the fascia of the internal oblique aponeurosis, with the external oblique aponeurosis positioned anteriorly and the transversus abdominis aponeurosis situated posteriorly. Below the arcuate line, however, the anatomical configuration changes significantly, as all three aponeurotic layers (external oblique, internal oblique, and transversus abdominis) transition to lie anterior to the rectus muscle. In this region, the only fascial layer posterior to the rectus is the transversalis fascia, which is distinct from the transversus abdominis aponeurosis. This structural variation contributes to differences in the biomechanical strength of the abdominal wall at various levels, influencing the susceptibility to hernia formation [7][8].

The development of ventral hernias is often precipitated by repetitive mechanical stresses on the abdominal wall, which result from increased intra-abdominal pressure. These stresses cause microscopic tears in the tissue, leading to a gradual weakening of the abdominal wall over time. Conditions or activities that elevate intra-abdominal pressure, such as chronic constipation, strenuous physical labor, childbirth, persistent coughing due to pulmonary diseases, or frequent vomiting associated with conditions like bulimia nervosa, significantly increase the risk of hernia formation. Additionally, surgical interventions further compromise the structural integrity of the abdominal wall. Following surgery, the tensile strength of the tissue is reduced to approximately 80% of its original maximum capacity. This reduction is cumulative; for example, after a second midline laparotomy, the tissue strength diminishes to 64% of its initial maximum (80% of 80%). This decrease in tensile strength is predicated on ideal conditions, assuming the absence of complicating factors such as malnutrition or postoperative infections, which can further impair tissue healing and strength [7][8]. The interplay between anatomical vulnerabilities, mechanical stressors, and surgical interventions underscores the multifactorial nature of ventral hernia pathophysiology. Understanding these mechanisms is critical for developing strategies to prevent hernia formation, optimize surgical outcomes, and mitigate the risk of recurrence. By addressing modifiable risk factors and employing surgical techniques that minimize tissue trauma, clinicians can improve the long-term integrity of the abdominal wall and reduce the incidence of ventral hernias.

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Histopathology

Histopathological evaluation of hernia sacs obtained from ventral wall hernias is a routine practice that can yield critical diagnostic information, occasionally revealing unexpected or incidental findings. A comprehensive retrospective review of 576 ventral wall hernia cases demonstrated that histologic examination identified malignancies in seven instances, five of which were not detected during preoperative clinical assessments. These findings underscore the diagnostic value of submitting hernia sacs for histopathological analysis, as it can uncover clinically occult malignancies or other significant pathologies. In addition to malignancies, the review identified other conditions, such as appendicitis, endometriosis, perivascular epithelioid cell tumors (PEComas), and pseudomyxoma peritonei, which may have otherwise gone undiagnosed. These findings highlight the potential for ventral hernias to serve as a conduit for the detection of underlying or associated diseases, some of which may have substantial implications for patient management and outcomes. The study concluded that routine histologic evaluation of hernia sacs is justified, as it provides an opportunity to identify rare but clinically relevant pathologies that could influence treatment strategies and improve patient care. This practice aligns with the broader principle of thorough diagnostic evaluation in surgical pathology, ensuring that no significant findings are overlooked during the management of ventral hernias.

History, Clinical, and Physical

The clinical presentation of an abdominal wall hernia typically includes symptoms such as localized pain, swelling, or a sensation of fullness at the site of the hernia, which may vary with changes in position or during activities that increase intra-abdominal pressure, such as the Valsalva maneuver. In cases where the hernia becomes incarcerated or strangulated, the affected area may exhibit erythema, tenderness, or noticeable asymmetry, indicating potential complications that require urgent intervention. While the diagnosis of an abdominal hernia is often established through a thorough history and physical examination, certain factors, such as severe obesity, a significant risk factor for hernia development—can complicate the assessment by obscuring physical findings. To enhance diagnostic accuracy, it is essential to examine the patient in multiple positions, including standing and lying down, as hernias may become more apparent with exertion or changes in posture. A comprehensive history is critical in evaluating patients with suspected ventral hernias. The history of present illness should focus on specific details, such as when the hernia was first noticed, any precipitating events, and associated symptoms like pain, erythema, constipation, nausea, or vomiting. Additionally, the size of the bulge, any changes in its dimensions, and factors influencing these changes should be documented. A detailed medical and surgical history, including any prior hernias or abdominal surgeries, is essential for understanding the patient's risk profile. Weight fluctuations, which can impact abdominal wall integrity, should also be noted. Social history, including occupation, dietary habits, exercise routines, smoking, and alcohol consumption, provides further context, as these factors can influence hernia development and progression. Importantly, patients should be questioned about a family history of connective tissue disorders, as these conditions are often hereditary and can predispose individuals to hernia formation. Collecting this comprehensive information aids in accurate diagnosis, risk stratification, and the development of an effective management plan tailored to the patient's unique circumstances.

Evaluation and Diagnosis

The evaluation of ventral hernias often requires adjunct diagnostic imaging modalities to confirm the diagnosis, assess the size of the hernia defect, and aid in preoperative planning. Ultrasound, computed tomography (CT) scans, and magnetic resonance imaging (MRI) are commonly utilized when the clinical diagnosis is uncertain or when detailed anatomical information is needed. These imaging studies provide valuable insights into the extent of the hernia, the involvement of surrounding structures, and the presence of complications such as incarceration or strangulation. Preoperative medical clearance is another critical component of the evaluation process, ensuring that patients are optimized for surgery. Surgeons typically follow established guidelines for preoperative assessment, assuming the need for general anesthesia, which

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is standard for most ventral hernia repairs. While open repairs can be performed under local or regional anesthesia, these approaches may not provide adequate muscle relaxation, potentially complicating the procedure and compromising outcomes. The risk associated with ventral hernia repair varies significantly depending on factors such as hernia size, location, and the complexity of the surgical technique required. For instance, small umbilical hernias pose a relatively low risk, whereas large hernias requiring component separation techniques carry a higher risk of complications. Patients with a history of smoking or chronic lung disease may benefit from preoperative pulmonary function tests to assess their respiratory capacity and mitigate perioperative risks. Additionally, it is essential to ensure that all age-appropriate cancer screening exams, such as colonoscopies, are completed before abdominal surgery to avoid the need for subsequent procedures. Discontinuation of antiplatelet and anticoagulant medications is also crucial, as their use increases the risk of hematoma formation, which can predispose patients to infectious complications. Adhering to these preoperative protocols enhances patient safety, optimizes surgical outcomes, and reduces the likelihood of postoperative morbidity [9][10].

Management and Treatment

The management of ventral hernias primarily involves surgical intervention, with the approach tailored to the patient's clinical presentation, hernia characteristics, and overall health status. Asymptomatic hernias are typically repaired on an elective basis, while hernias presenting with strangulation require immediate surgical attention due to the risk of tissue necrosis and life-threatening complications. Incarcerated hernias without strangulation, although not surgical emergencies, should be addressed within a reasonable timeframe after discussing the risks and benefits of surgery with the patient. Non-surgical management, such as the use of abdominal binders, trusses, or corsets, is generally considered ineffective and is reserved for patients who are not suitable candidates for surgery due to significant comorbidities or other contraindications [11][12][13].

Surgical Techniques

Surgical techniques for ventral hernia repair have evolved significantly, with several principles guiding modern practices. The most critical principle is achieving a tension-free closure to minimize the risk of recurrence. Other key tenets include the use of mesh with a 3 to 5 cm overlap to reinforce the repair, meticulous handling of the mesh to prevent infection, and employing a sublay technique with fascial closure whenever possible. The simplest approach is primary open repair without mesh, which is typically reserved for small fascial defects less than 2 cm in size. For larger defects, open repair with mesh is preferred, with various options available regarding mesh type (synthetic, biologic, or absorbable) and placement (onlay, inlay, sublay, or underlay). Mesh placement has been shown to reduce recurrence rates significantly compared to primary suture repair.

Laparoscopic Repair

Laparoscopic ventral hernia repair has gained widespread acceptance due to its advantages over open techniques, including lower overall complication rates, shorter hospital stays, and faster recovery times. While recurrence rates for laparoscopic repair are generally comparable to or slightly lower than those for open repair, the difference is not always statistically significant. However, laparoscopic repair is technically more challenging and carries a higher risk of visceral injury, particularly during adhesiolysis. Advances in laparoscopic instrumentation, such as wristed tools that offer greater freedom of motion, have improved the feasibility of these procedures, though further research is needed to confirm their benefits.

Robotic-Assisted Repair

Robotic-assisted ventral hernia repair has emerged as another innovative approach, combining the benefits of laparoscopy with enhanced precision and maneuverability. Robotic systems facilitate fascial defect closure easier compared to traditional laparoscopic instruments, while maintaining the advantages of minimally invasive surgery, such as smaller incisions and reduced postoperative pain. However, robotic surgery is associated with higher costs and longer operative times, and no landmark studies have yet

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demonstrated its superiority over laparoscopy in terms of long-term outcomes. For large or complex hernias where tension-free closure cannot be achieved, component separation techniques are often employed. These methods involve releasing the abdominal wall muscles to allow medialization and closure of the defect. The open component separation technique with onlay mesh involves creating large skin flaps, incising the external oblique muscle, and mobilizing the rectus muscles to achieve midline closure. This approach can address defects up to 10 cm in diameter. Alternatively, endoscopic component separation techniques use minimally invasive methods to release the external oblique muscle, reducing the risk of wound complications associated with open techniques. Both methods typically involve mesh reinforcement to enhance durability and reduce recurrence rates. In summary, the treatment and management of ventral hernias require a nuanced approach that considers the size and complexity of the hernia, patient factors, and surgical expertise. While open repair remains a viable option for small defects, laparoscopic and robotic techniques offer significant advantages for many patients. Component separation techniques are reserved for large or complex hernias, with the choice of method depending on the surgeon's experience and the patient's specific needs. Adherence to surgical principles, such as tension-free closure and mesh reinforcement, is essential to achieving optimal outcomes and minimizing recurrence [11][12][13].

Transversus Abdominis Muscle Release (TAR)

Transversus abdominis muscle release (TAR), also known as posterior component separation, is a sophisticated surgical technique used for the repair of large or complex ventral hernias. This method involves developing the retro-muscular space, which extends from the medial rectus sheath into the plane between the transversus abdominis and internal oblique muscles. The posterior rectus sheath is incised laterally, and the transversus abdominis muscle is released medial to the linea semilunaris. This creates a broad plane that spans from the central tendon of the diaphragm superiorly to the space of Retzius inferiorly and extends laterally into the retroperitoneum on both sides. A key advantage of this technique is the preservation of the neurovascular bundles that innervate the medial abdominal wall, which helps maintain muscle function and reduce postoperative complications. Once the plane is developed, a synthetic mesh is placed in a sublay fashion, positioned above the posterior fascial layer but beneath the rectus and internal oblique muscles. The posterior rectus fascia is then advanced medially and closed, restoring the linea alba anterior to the mesh. This approach provides a robust, tension-free repair and is particularly effective for large hernias that cannot be addressed with simpler techniques. However, TAR procedures are often lengthy and technically demanding, requiring significant surgical expertise and experience. Despite these challenges, TAR has gained popularity due to its ability to achieve durable repairs with low recurrence rates, even in complex cases [11][12][13].

Parastomal Hernias: Prevention and Repair

Parastomal hernias are a specific type of abdominal wall hernia that occurs adjacent to an ostomy site. It is estimated that up to 30% of patients with ostomies develop parastomal hernias, with the risk varying depending on the type of ostomy. Loop colostomies are associated with the highest risk, followed by end colostomies, loop ileostomies, and end ileostomies. Currently, the most effective strategy to prevent parastomal hernias is the use of prophylactic mesh at the time of ostomy creation. This approach has been shown to significantly reduce the incidence of hernia formation. For patients who develop parastomal hernias, surgical repair is often necessary, particularly in cases of symptomatic or complicated hernias. If an ostomy reversal is planned, the hernia repair is typically delayed until the reversal procedure. However, emergency repair may be required in cases of incarceration or strangulation. Two commonly used techniques for parastomal hernia repair are the modified Sugarbaker and keyhole methods. Both can be performed laparoscopically or via an open approach [11][12][13].

- Modified Sugarbaker Technique: This method involves lateralizing the bowel by tracking it from the hernia sac between the abdominal wall and the mesh prosthesis into the peritoneal cavity. The mesh is placed over the defect, with the bowel entering the abdominal cavity laterally to the mesh. This technique has been associated with lower recurrence rates in some studies, though larger trials are needed to confirm its superiority.

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- Keyhole Technique: In this approach, a slit is made in the mesh to accommodate the bowel, which is then secured around the stoma. The mesh is fixed in place to patch the defect. While effective, this technique has been associated with higher recurrence rates compared to the Sugarbaker method.

Mesh Selection: Synthetic vs. Biologic

The choice of mesh is a critical factor in hernia repair, with options including synthetic and biologic meshes. Each type has distinct advantages and disadvantages, and the decision is often guided by the clinical scenario and surgeon preference [11][12][13].

Synthetic Mesh

Synthetic meshes are the most commonly used and are typically made from materials such as polypropylene, polyester, or polytetrafluoroethylene (PTFE). Lightweight synthetic meshes, introduced in the late 1990s, have become widely accepted due to their superior flexibility and reduced risk of complications. However, they are not immune to infection or recurrence.

- Macroporous Mesh: Meshes with pores larger than 3 mm are preferred because they reduce the risk of infection and allow for better tissue integration. If infection does occur, macroporous meshes are more likely to be treatable with antibiotics, avoiding the need for mesh removal.

- ePTFE Mesh: This type of mesh has a low risk of adhesion formation but a higher risk of infection. It is often used in specific cases where adhesion prevention is a priority.

- Dual-Sided Mesh: Designed for intraperitoneal placement, these meshes feature one side coated with an anti-adhesive barrier to minimize adhesion formation. While not 100% effective, they have been shown to reduce adhesions and simplify adhesiolysis if needed.

- Sutureless Mesh: These meshes adhere to tissues without sutures, reducing postoperative pain and the risk of mesh migration.

Biologic Mesh

Biologic meshes, derived from human or animal tissues, have gained popularity over the past decade, particularly in contaminated or infected fields. However, they are significantly more expensive than synthetic meshes and are generally considered less durable.

- Acellular Collagen Matrix: Biologic meshes are typically composed of acellular collagen derived from human dermis or porcine small intestine submucosa. They are less likely to become infected but can still provoke a foreign body reaction, leading to adhesions.

- Absorbable Mesh: Meshes made from materials like Vicryl are used in infected fields but are absorbed over time, leaving only native tissue. While useful in specific scenarios, they do not provide long-term reinforcement.

The management of ventral hernias, including complex cases requiring TAR or parastomal hernia repair, requires a tailored approach based on the patient's condition, hernia characteristics, and surgical expertise. Advances in surgical techniques and mesh technology have significantly improved outcomes, but careful consideration of mesh type and placement is essential to minimize complications and recurrence. As research continues, further refinements in these methods are expected to enhance the safety and efficacy of ventral hernia repair [11][12][13].

Differential Diagnosis

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The differential diagnosis for a ventral hernia includes a range of conditions that may present similar symptoms, such as localized swelling, pain, or a palpable mass in the abdominal wall. Diastasis recti, a separation of the rectus abdominis muscles, can mimic a hernia but lacks a fascial defect. Abscesses or seromas may present as fluid-filled collections, often with associated erythema or tenderness, but are not associated with a reducible bulge. Muscle strains can cause pain and swelling but typically do not produce a distinct mass. Wound hematomas or rectus sheath hematomas may present as painful, firm masses, often following trauma or surgery, but are not reducible. Lymphadenopathy or soft tissue malignancies can also present as abdominal wall masses but are typically fixed and non-reducible. A thorough clinical evaluation, supplemented by imaging studies, is essential to distinguish these conditions from a true hernia.

Staging

The staging and classification of ventral hernias remain challenging due to the lack of a universally accepted system. One of the more widely recognized frameworks is the European Hernia Society (EHS) classification system, which categorizes hernias into two main groups: primary abdominal wall hernias and incisional abdominal wall hernias. Primary hernias, which occur without a history of prior surgery, are typically limited to specific anatomical locations, such as the midline (e.g., umbilical or epigastric hernias) or lateral regions (e.g., Spigelian or lumbar hernias). These hernias are classified based on two primary variables: length and width, which provide a straightforward method for documenting their size and extent. Incisional hernias, which develop at the site of previous surgical incisions, are more complex to classify due to their variability in location and size. Like primary hernias, they are also described in terms of length and width, but their occurrence anywhere on the abdominal wall adds an additional layer of complexity. A significant limitation of the EHS system is its failure to incorporate patient-specific risk factors, such as obesity, diabetes, or smoking status, as well as wound classification (e.g., clean, contaminated, or infected). These factors play a critical role in determining surgical outcomes and recurrence rates, yet they are not accounted for in this classification system. In cases where a substantial portion of the abdominal contents, often defined as half or more, protrudes into the hernia sac, the condition is termed loss of domain. This scenario presents unique challenges for surgical repair due to the reduced intra-abdominal space and increased tension on the abdominal wall. While the EHS classification provides a useful framework for describing hernia size and location, the development of a more comprehensive system that integrates patient-specific factors and clinical context remains an area of ongoing research and discussion within the surgical community. Such a system would need to balance complexity with practicality to ensure widespread adoption and utility [14].

Prognosis

The prognosis following ventral hernia repair varies significantly among patients and is influenced by several factors, with the circumstances of the original operation being the most predictive of postoperative outcomes. Emergency surgeries, particularly those involving strangulated hernias requiring bowel resection, are associated with higher morbidity and recurrence rates. This is due to the increased risk of contamination, which complicates the surgical field and often precludes the use of synthetic mesh, a key component in reducing recurrence in elective repairs. The classification of the wound at the time of surgery is a critical determinant of postoperative complications and should be meticulously documented in the operative record. Wound classification systems categorize surgical sites based on the level of contamination, ranging from clean (Class I) to dirty or infected (Class IV). A clean wound (Class I) involves an incision where no inflammation is encountered, sterile technique is maintained, and the respiratory, alimentary, and genitourinary tracts are not entered. In contrast, a clean-contaminated wound (Class II) occurs when these tracts are entered under controlled conditions without significant contamination. A contaminated wound (Class III) involves major breaks in sterile technique, spillage from the gastrointestinal tract, or the presence of acute, nonpurulent inflammation. Traumatic wounds older than 12 to 24 hours also fall into this category. Finally, a dirty or infected wound (Class IV) is characterized by perforated viscera, purulent inflammation, or delayed treatment of traumatic wounds with fecal contamination or devitalized tissue. These classifications directly impact the risk of surgical site infections, mesh-related complications, and

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overall morbidity, underscoring the importance of careful preoperative assessment and intraoperative decision-making to optimize patient outcomes [14].

Complications

Complications following ventral hernia repair can significantly impact patient outcomes, with recurrence being one of the most common concerns. The introduction of mesh has markedly reduced recurrence rates, but these rates still vary depending on the surgical technique employed. Laparoscopic repairs with mesh have recurrence rates of approximately 10% to 12%, while open-mesh repairs range from 13% to 15%. Open-tissue repairs, which do not utilize mesh, have the highest recurrence rates, at 18% to 20%. Component separation techniques, often used for large or complex hernias, report recurrence rates as high as 20%, though these cases are not directly comparable to standard repairs due to the extensive nature of the defects and the need for abdominal wall reconstruction. Mesh infection is a particularly devastating complication, often necessitating a second, more complex operation and carrying a high risk of hernia recurrence. Risk factors for mesh infection include high BMI, chronic obstructive pulmonary disease (COPD), prior surgical site infections, longer operative times, lack of tissue coverage over the mesh, and enterotomy. While mesh salvage with antibiotics is possible in some cases, explantation of the infected mesh is frequently required, further complicating the patient's recovery and increasing the likelihood of recurrence. Respiratory morbidity is another significant concern, particularly in cases of abdominal wall reconstruction. The reduction in abdominal cavity volume following repair can exert upward pressure on the diaphragm, potentially leading to hypoxia and the need for intubation. To mitigate these risks, some institutions have implemented protocols that emphasize adequate pain control (e.g., patient-controlled analgesia, regional blocks, or epidurals), early ambulation, and the avoidance of routine nasogastric tube use. While evidence does not strongly support the use of lung expansion therapies such as deep breathing exercises, incentive spirometry, or CPAP, these interventions remain commonly employed in clinical practice. Addressing these complications requires a multidisciplinary approach to optimize surgical techniques, patient selection, and postoperative care.

Postoperative and Rehabilitation Care

Patients should follow a gradual lifting progression: 10 pounds (4.5 kg) in the first week, 20 pounds (9 kg) in the second week, and full activity over six weeks. Limiting narcotic use is essential to reduce addiction risk and prevent constipation. A multimodal pain management approach—including acetaminophen, anti-inflammatory drugs, neuropathic agents, muscle relaxants, and regional or post-surgical nerve blocks—effectively minimizes opioid consumption. Stool softeners and laxatives are commonly recommended to prevent straining and bloating. While no specific dietary restrictions exist, a high-fiber diet supports digestive health postoperatively. Patients can shower within 24 to 48 hours after surgery. Providing postoperative instructions at multiple stages enhances patient understanding and adherence. Supplementing verbal guidance with educational materials has been shown to reduce complications across various medical specialties.

Patient Education

Preventing acquired ventral hernias primarily involves minimizing incisional hernias. However, enforcing patient adherence to preventive measures is challenging. Proper abdominal closure is critical, with a recommended suture length-to-wound length ratio greater than 4. Each fascial closure bite should follow the incision's longitudinal axis with a depth of 5–10 mm. Surgeons must achieve a tension-free closure and ensure port sites of 10 mm or larger are properly closed. Although incisional hernias can develop at smaller port sites, such cases are rare. Further research is needed to determine the optimal suture type for large incisions. Evidence suggests that running, slowly absorbable or non-absorbable monofilament sutures are effective. Non-absorbable sutures reduce hernia formation rates but increase the risk of chronic pain and sinus drainage. Monofilament sutures are preferred over multifilament due to their lower infection risk. Preventing surgical wound infections is the most effective strategy for reducing ventral hernia incidence. Infections significantly increase the likelihood of hernia formation and mesh-related complications, often necessitating additional surgery. Laparoscopic repairs are consistently associated with lower infection rates

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than open procedures. Optimizing patient health before surgery—such as promoting smoking cessation, improving nutrition, encouraging weight loss, ensuring physical rehabilitation, and maintaining strict glycemic control—reduces infection risks. Numerous perioperative measures further decrease surgical site infections, including prophylactic antibiotics, prevention of hypothermia, adherence to sterile techniques, and proper skin preparation. While abdominal binders do not lower ventral hernia occurrence or recurrence, they can improve patient comfort. Comprehensive preoperative planning and meticulous surgical techniques remain the cornerstone of reducing ventral hernia risks and improving postoperative outcomes.

Enhancing Healthcare Professionals Outcomes

Enhancing healthcare team outcomes in the management of ventral hernias requires a collaborative, multidisciplinary approach involving surgeons, dietitians, nurses, and physical therapists. Given the high risk of recurrence and the complexity of some cases, patient education plays a pivotal role in improving outcomes. Providing patients with comprehensive literature, clear instructions, and detailed discussions about their condition, surgical options, and postoperative care has been shown to enhance understanding and adherence to treatment plans. Additionally, offering accessible resources for patients to ask questions or contact healthcare providers has proven effective in reducing unnecessary emergency room visits within 30 days of surgery, thereby improving patient satisfaction and reducing healthcare costs. The prognosis for ventral hernia repair varies significantly based on factors such as hernia size, patient comorbidities, and the urgency of the procedure. Elective repairs generally yield the best outcomes, with lower complication and recurrence rates. However, patients presenting with incarcerated or strangulated hernias face a more guarded prognosis, with mortality rates exceeding 5% in cases of strangulation due to the risk of bowel necrosis and systemic complications. Laparoscopic herniorrhaphy, while minimally invasive and associated with shorter recovery times, is not without risks. Serious complications, such as bowel injury from surgical instrumentation, can occur, underscoring the importance of surgical expertise and careful patient selection. By fostering a team-based approach that emphasizes patient education, preoperative optimization, and postoperative support, healthcare providers can improve outcomes for patients with ventral hernias. This collaborative model not only addresses the immediate surgical needs but also promotes long-term recovery and reduces the burden of recurrence and complications [15][16][17].

Main Role of Anesthesiologists in this Condition

The role of anesthesiologists in the management of ventral hernias is critical, as they ensure patient safety, optimize physiological conditions, and facilitate successful surgical outcomes. Their responsibilities begin with a thorough preoperative assessment to evaluate the patient's overall health, identify comorbidities, and assess the risk of complications. This evaluation is particularly important for patients with conditions such as obesity, chronic obstructive pulmonary disease (COPD), or cardiovascular issues, which can increase the complexity of anesthesia management. Based on this assessment, the anesthesiologist tailors the anesthetic plan to minimize risks and optimize intraoperative conditions. During surgery, the anesthesiologist plays a key role in maintaining hemodynamic stability, ensuring adequate oxygenation, and managing pain. For open ventral hernia repairs, general anesthesia is typically administered, requiring careful monitoring of the patient's respiratory and cardiovascular systems. In laparoscopic or robotic-assisted procedures, the anesthesiologist must also manage the physiological effects of pneumoperitoneum (insufflation of the abdomen with carbon dioxide), which can impact respiratory mechanics, cardiac output, and venous return. Close monitoring and adjustments are necessary to prevent complications such as hypercapnia, hypotension, or arrhythmias. Pain management is another critical aspect of the anesthesiologist's role. Effective postoperative pain control not only enhances patient comfort but also facilitates early mobilization, which is essential for reducing the risk of complications such as deep vein thrombosis (DVT) and pulmonary atelectasis. Techniques such as regional anesthesia (e.g., epidural or transversus abdominis plane (TAP) blocks) or multimodal analgesia (combining opioids with non-opioid medications) are often employed to achieve optimal pain relief while minimizing opioid-related side effects. In cases of emergency hernia repairs, such as those involving strangulation or bowel obstruction, the anesthesiologist must rapidly stabilize the patient, address any metabolic derangements (e.g., electrolyte imbalances or acidosis), and prepare for potential complications such as sepsis or hemodynamic instability. Their expertise in managing

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high-risk patients and critical situations is invaluable in ensuring positive outcomes. Overall, the anesthesiologist's role is integral to the safe and effective management of ventral hernias, from preoperative assessment to postoperative recovery.

Conclusion

Ventral hernias represent a significant clinical and surgical challenge, with a high prevalence and substantial impact on patient quality of life and healthcare systems. This updated review underscores the importance of a comprehensive, multidisciplinary approach to the management of ventral hernias, encompassing accurate diagnosis, tailored surgical techniques, and meticulous postoperative care. The etiology of ventral hernias is multifactorial, involving both congenital and acquired factors, with obesity, prior surgeries, and repetitive abdominal stress being major contributors. Understanding these underlying causes is critical for both prevention and effective management. Surgical repair remains the cornerstone of treatment, with advancements in minimally invasive techniques, such as laparoscopic and robotic-assisted repairs, offering significant benefits in terms of reduced recurrence rates, shorter hospital stays, and faster recovery times. However, these techniques are not without risks, including visceral injury and technical complexity. The use of mesh, particularly synthetic macroporous variants, has revolutionized hernia repair by providing durable reinforcement and reducing recurrence rates. Nonetheless, mesh infection remains a devastating complication, often necessitating complex revision surgeries. For large or complex hernias, component separation techniques, such as transversus abdominis release (TAR), have proven effective in achieving tension-free repairs. However, these procedures are technically demanding and require significant surgical expertise. Parastomal hernias, which occur adjacent to ostomy sites, present unique challenges and often require specialized repair techniques, with prophylactic mesh placement showing promise in reducing incidence. Postoperative care and patient education are equally critical in ensuring successful outcomes. Multimodal pain management, early ambulation, and adherence to activity restrictions can significantly reduce complications such as respiratory morbidity and deep vein thrombosis. Patient education, including clear instructions and accessible resources, has been shown to improve adherence to postoperative protocols and reduce emergency room visits. In conclusion, the management of ventral hernias requires a nuanced, evidence-based approach that considers patient-specific factors, hernia characteristics, and surgical expertise. Continued advancements in surgical techniques, mesh technology, and multidisciplinary collaboration are essential to further improve outcomes and reduce the burden of recurrence and complications. By addressing modifiable risk factors and optimizing perioperative care, healthcare providers can enhance the quality of life for patients with ventral hernias.

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الفتوق البطنية غير الإربية: مراجعة محدثة لمقدمي الرعاية الصحية

الملخص

الخلفية: الفتوق البطنية، التي تُعرف بأنها عيوب غير إربية وغير فجوية في جدار البطن، تمثل مشكلة سريرية مهمة، حيث يتم إجراء حوالي 350,000 عملية إصلاح سنويًا في الولايات المتحدة. يمكن أن تؤثر هذه الفتوق على جودة الحياة، وتؤدي إلى دخول المستشفى، وفي الحالات الشديدة، قد تسبب الوفاة. تشمل أسبابها عوامل خلقية ومكتسبة، مثل السمنة، والعمليات الجراحية السابقة، والإجهاد المتكرر على البطن. الجراحة هي العلاج الأساسي، لكن تكرار الفتق والمضاعفات لا يزالان تحديين رئيسيين.

الهدف: تهدف هذه المراجعة إلى تقديم نظرة محدثة حول مسببات الفتق البطني، وانتشاره، وآلياته المرضية، وتشخيصه، وإدارته، مع التركيز على الاستراتيجيات المبنية على الأدلة لتحسين النتائج وتقليل المضاعفات. كما تناقش الدراسة الدور الحاسم لأطباء التخدير في جراحة الفتق البطني وإدارة المرحلة بعد الجراحة.

الطرق: تعتمد المراجعة على تحليل الأدبيات الحديثة حول الفتق البطني، بما في ذلك أنظمة التصنيف، وطرق التشخيص، والتقنيات الجراحية، والرعاية بعد الجراحة. يتم تسليط الضوء على دور التصوير الطبي، وتحسين الحالة الصحية قبل الجراحة، والمقارنة بين استخدام الشبكات الاصطناعية والبيولوجية. كما تناقش أهمية التعاون متعدد التخصصات وتعليم المرضى في تحسين النتائج.

النتائج: تتفاوت نتائج إصلاح الفتق البطني حسب التقنية الجراحية، وعوامل المريض، وخصائص الفتق. أظهرت الجراحات التنظيرية والروبوتية معدلات تكرار أقل وفترات تعافٍ أسرع مقارنةً بالجراحة المفتوحة. يقلل استخدام الشبكات بشكل كبير من خطر تكرار الفتق، لكن العدوى تظل من المضاعفات الخطيرة. تعد تقنيات فصل المكونات، مثل تحرير العضلة المستعرضة للبطن(TAR) ، فعالة في علاج الفتق الكبير، ولكنها تتطلب مهارات تقنية متقدمة. تتطلب الفتوق حول الفغرة تقنيات إصلاح متخصصة، حيث يقلل وضع الشبكة الوقائي من معدل حدوثها.

الاستنتاج: تمثل الفتوق البطنية تحديًا جراحيًا معقدًا يتطلب استراتيجيات مخصصة بناءً على عوامل المريض وخصائص الفتق. ساهمت التطورات في التقنيات الجراحية وتكنولوجيا الشبكات والرعاية متعددة التخصصات في تحسين النتائج، لكن تكرار الفتق والمضاعفات لا يزالان مصدر قلق كبير. يظل البحث المستمر والالتزام بالممارسات المبنية على الأدلة ضروريين لتعزيز النتائج العلاجية للمرضى.

الكلمات المفتاحية :الفتق البطني، إصلاح الفتق، الشبكات الجراحية، التنظير، فصل المكونات، الفتق حول الفغرة، التكرار، المضاعفات.