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NAVIGATING COMPLEXITY: BILATERAL ABDOMINAL WALL PALSY FOLLOWING ETEP RETRORECTUS VENTRAL HERNIA REPAIR

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Abstract
Recurrent incisional hernias pose a significant surgical challenge, especially when associated with anatomical and functional deficiencies. This report details the case of a 36-year-old female who underwent three surgeries over two years for recurrent incisional hernias, culminating in the diagnosis of bilateral rectus abdominis palsy. Diagnostic modalities including computed tomography (CT) imaging with defect reconstruction, 3D printing, and electromyography (EMG) were utilized to determine the underlying etiology and guide surgical management. This case underscores the importance of innovative diagnostic approaches in managing complex abdominal wall hernias and is the first reported case of abdominal wall palsy following eTEP repair.

INTRODUCTION

Incisional hernias are a common complication of abdominal surgeries, with recurrence rates ranging from 10% to 30% despite advancements in surgical techniques. Various newer minimally invasive surgeries for ventral hernia repair have emerged over the past 3-4 decades, with intraperitoneal onlay mesh (IPOM) surgery initially being the main laparoscopic technique. Since 2012, the enhanced-view totally extraperitoneal (eTEP) approach for ventral hernia repair, pioneered by Dr. Jorge Daes, has revolutionized laparoscopic hernia repair. This method is rapidly gaining popularity due to its distinct advantages over IPOM, including reduced mesh-related complications and superior anatomical reconstruction. However, eTEP is associated with a long learning curve and technically demanding surgical steps.

During retrorectus plane dissection in eTEP, neurovascular bundles supplying the abdominal muscles are at risk of injury, given their exit from the linea semilunaris into the retrorectus plane. Despite theoretical concerns, complications from nerve injuries during eTEP have not been reported. Here, we present the first documented case of bilateral rectus abdominis palsy following eTEP ventral hernia repair.

Case Presentation

A 36-year-old female underwent an eTEP Rives-Stoppa ventral hernia repair in a nursing home in 2023 for an umbilical hernia along with puerperal sterilization. The procedure was uncomplicated, but in April 2024, she presented with an obstructed recurrent umbilical hernia, for which an emergency open anatomical repair was performed. In November 2024, the patient presented with a vague swelling in the left paraumbilical region, accompanied by visible cough impulse and irreducibility. Examination revealed a positive cough impulse, and an irreducible incisional hernia in left paraumbilical region associated with a large bulge in the anterior abdominal wall during head-raising and leg-raising tests, with no divarication of recti suggesting a rectus abdominis palsy.

The patient was diagnosed with a left rerecurrent ventral hernia with irreducibility and suspected rectus abdominis palsy the exact size of defect could not be assessed because of vague irreducible swelling.

a) b)

Figure 1: Incisional Hernia swelling in the left paraumbilical region
a) on inspection of the abdomen b) swelling becomes more prominent on leg raising test

Diagnostic Workup

1. Diagnostic workup for assessment of hernia

a) USG findings: No evidence of obvious defect in the umbilical/ paraumbilical region.

b) Computed Tomography (CT): The first challenge was to confirm the defect size and contents. A contrast-enhanced CT (CECT) abdomen revealed:

A 9.37 (transverse) × 5.20 (craniocaudal) in the left paraumbilical region with bowel (large bowel loops) and omentum herniating through it.

Another 2 cm supraumbilical defect with bowel and omentum herniation.

Thinning of the rectus abdominis muscles bilaterally.

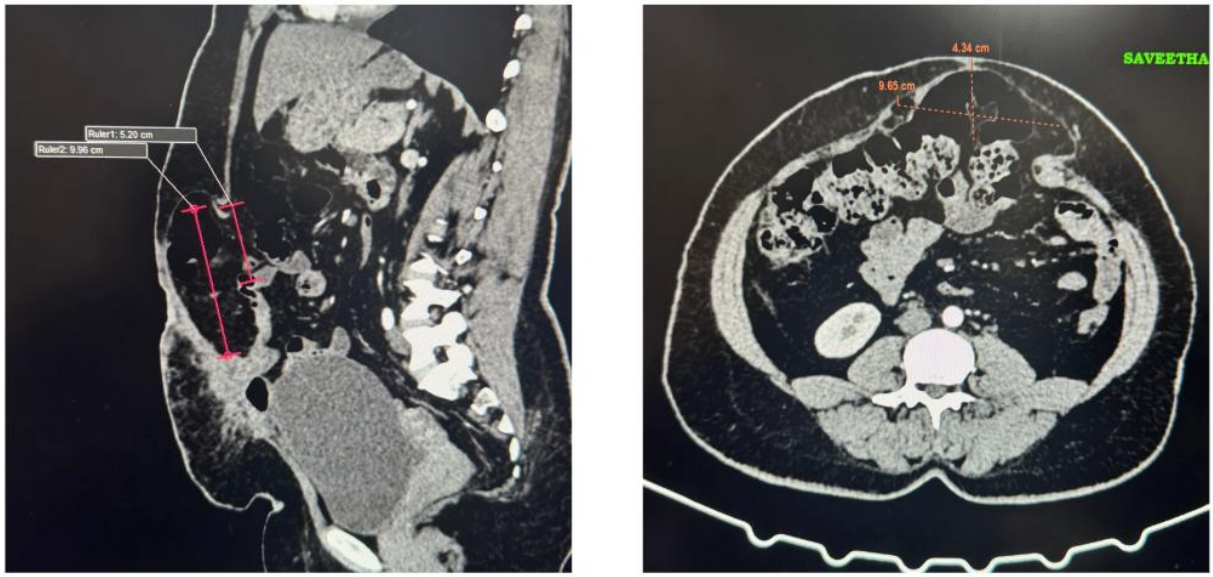
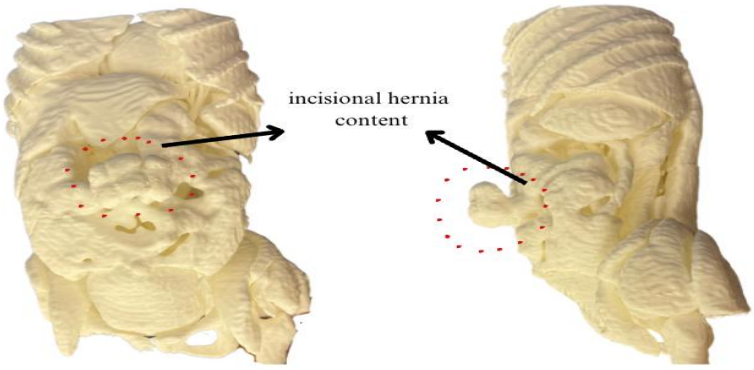


Figure 2: CECT abdomen findings

c) 3D Printing: Despite CT findings, the morphology of the defect was not entirely clear. A 3D reconstruction of the abdominal wall was created using DICOM data from the CT scan. The model was printed using a BambuLab X1-Carbon 3D printer with polylactic acid filament. The 3D-printed model provided enhanced and precise visualization of the hernia contents, defect size, and anatomical location, aiding significantly in surgical planning.



a) b)

Figure: a) Anteroposterior view of the 3D printed model showing the contents of the incisional hernia. b) Lateral view of the 3D printed model

2. Diagnostic workup for assessment of rectus palsy

a) Electromyography (EMG): EMG of bilateral rectus abdominis muscle showed:

- Bilateral rectus abdominis late recruitment and incomplete interference.
- Neurogenic pattern with no spontaneous activity.
- These findings confirmed bilateral rectus abdominis palsy, which could not be corrected.

a) b) c)

Figure 3: Electromyography of rectus abdominis muscle a) Palpation of rectus abdominis muscle on leg raising test. b) Placing of electrode over the rectus abdominis muscle. c) Assessing EMG of rectus abdominis muscle on leg raising test

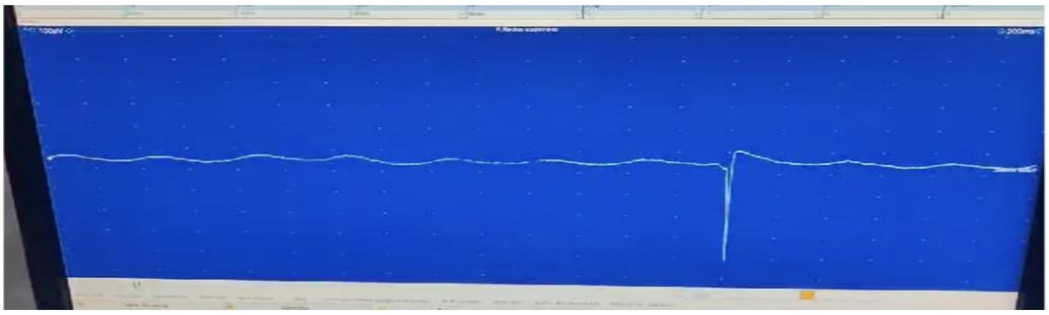


Figure: EMG showing late recruitment phase of the rectus abdominis muscle

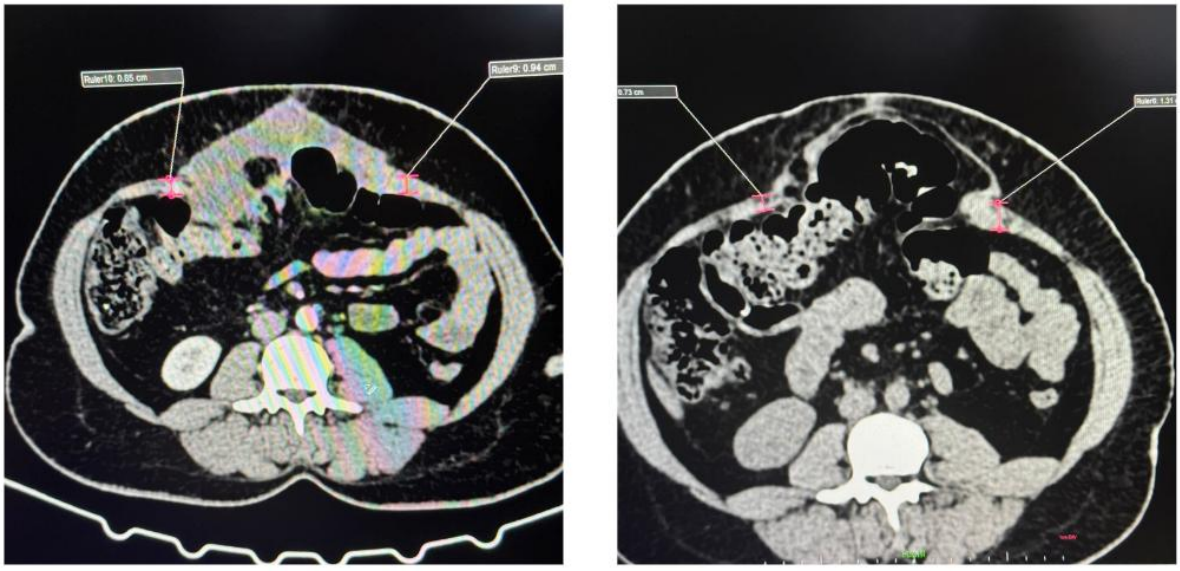
b) Neurology consultation: Neurology consultation was obtained to evaluate suspected rectus abdominis palsy. Corroborating with the EMG findings the patient was confirmed to have bilateral rectus abdominis palsy

c) Comparative CT scan findings analysis:

The CT Abdomen findings taken in April 2024 and October 2024 were compared to evaluate the bulk and thickness of the rectus abdominis muscles and the dimensions of the hernia defects. The comparison provides key insights into the progression of the patient's condition, with evidence supporting the presence of rectus abdominis palsy.

Parameter	April 2024	October 2024
Defect Size (cm)	13.41 (craniocaudal) × 10.36 (transverse)	9.37 (transverse) × 5.20 (craniocaudal)
Hernial Sac Dimensions (cm)	4.63 (anterioposterior) × 10.61 (transverse) × 11.06 (craniocaudal)	4.34 (anterioposterior) × 9.65 (transverse) × 9.96 (craniocaudal)
Right Rectus Thickness (cm)	0.85	0.73
Left Rectus Thickness (cm)	0.94	1.31

Table 1: Comparative findings of a CT abdomen study.



a) b)

Figure 4: Comparative findings of rectus abdominis thickness a) April 2024, b) October 2024.

Interpretation:

- Right Rectus Abdominis: The thickness decreased from 0.85 cm to 0.73 cm, which is indicative of muscle atrophy or disuse, strongly associated with rectus palsy.
- Left Rectus Abdominis: The thickness increased from 0.94 cm to 1.31 cm, attributed to fat infiltration and replacement following muscle atrophy.

The comparative CT findings conclusively demonstrate rectus abdominis palsy, evidenced by muscle thinning and functional asymmetry. These findings further validate the utility of advanced imaging in diagnosing and monitoring abdominal wall musculature integrity.

Plan

1. Onlay Repair Selection:

Given that the retrorectus plane was breached during the previous eTEP surgery, an onlay repair was chosen as the most suitable technique to avoid further complications in the compromised retrorectus space.

2. Defect Dimensions and Compartment Separation Technique:

Considering the defect dimensions (9.37 cm transversely and 5.20 cm craniocaudally), a compartment separation technique was deemed necessary for adequate tension-free closure. An anterior compartment separation technique was preferred over a posterior compartment separation (Transverse Abdominis Release, TAR). The rationale for this choice was the compromised retrorectus plane from the previous surgery and the presence of rectus abdominis palsy, which reduces the rectus muscle's ability to stabilize and maintain the mesh in position effectively.

This approach was tailored to address the unique challenges posed by the patient's condition, ensuring optimal outcomes while minimizing the risk of recurrence.

Operative Details

- Diagnostic laparoscopy confirmed hernial sac contents and adhesions.
- Midline laparotomy was performed with adhesiolysis and excision of the excess sac.
- The hernia defect was repaired anatomically using loop Ethilon.
- A polypropylene mesh (20x25 cm) was placed and fixed with Prolene sutures.
- Bilateral anterior component separation was performed to release tension.
- Drains were placed, and excess skin excised.
- Postoperative Course: The recovery was uneventful, and the patient remains asymptomatic at 6-week follow-up.

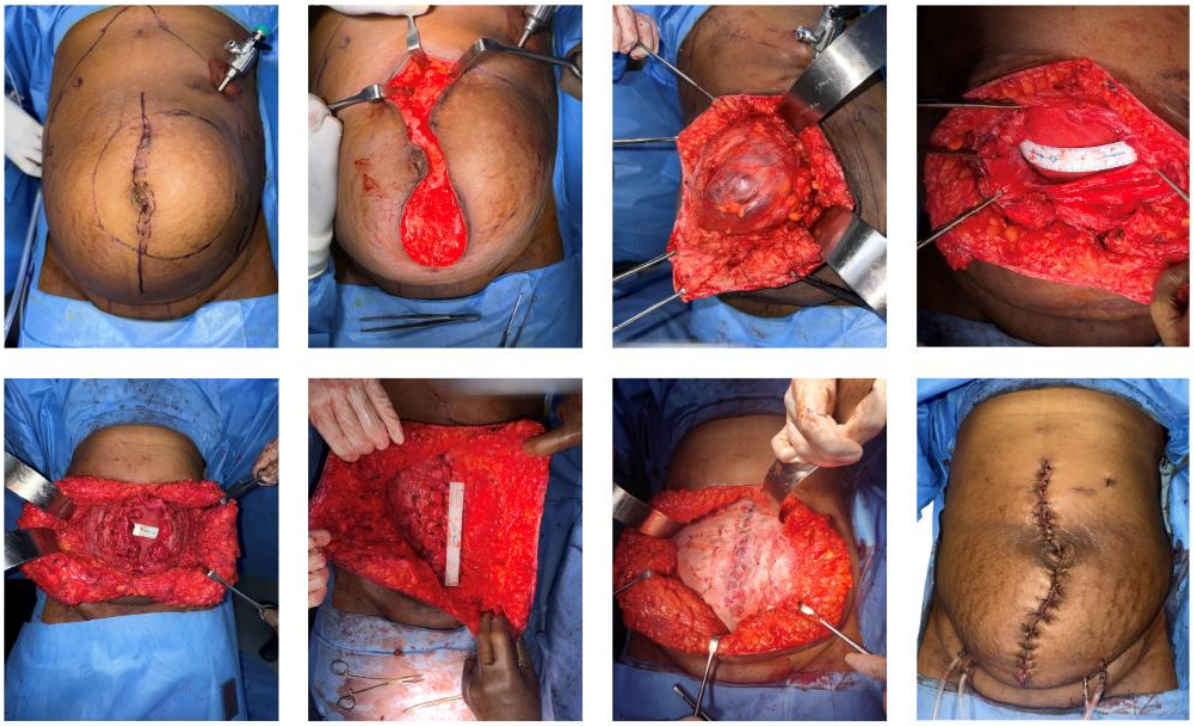


Figure 5: Operative steps

Figure 6: 6 weeks post op on leg raising test

DISCUSSION

Recurrent incisional hernia in this patient was exacerbated by bilateral rectus abdominis palsy and muscle thinning. This is the first documented case of abdominal wall palsy following eTEP repair, a complication likely resulting from inadvertent nerve injury during retrorectus plane dissection. The novel application of diagnostic tools, including CT, 3D printing, and EMG, was pivotal in diagnosing and planning the surgical approach.

Computed Tomography: CT imaging provided precise defect dimensions and herniated contents, essential for initial assessment.

3D Printing: The 3D model provided a tangible representation of the defect and hernial contents, greatly enhancing preoperative planning and patient counseling. The ability to visualize the defect's morphology in three dimensions is a significant advantage over traditional imaging.

Electromyography: EMG confirmed the functional deficit of the rectus muscles, a rarely explored factor in recurrent hernias. Neurology consultation and documentation further validated the findings.

This case highlights the need for vigilance during retrorectus dissection in eTEP and suggests incorporating advanced diagnostic modalities for complex recurrent hernias. Future studies are warranted to explore the prevalence of such complications and refine surgical techniques.

CONCLUSION

This case report presents a unique and complex complication following eTEP retrorectus ventral hernia repair, highlighting several critical aspects of advanced hernia management:

1. It is the first documented instance of bilateral rectus abdominis palsy following eTEP repair, underscoring the potential risks associated with retrorectus dissection during this procedure.
2. The case demonstrates the value of a comprehensive diagnostic approach in complex recurrent hernias. The integration of advanced imaging techniques (CT scan), innovative visualization methods (3D printing), and functional assessments (EMG) proved crucial in accurate diagnosis and surgical planning.
3. The successful management of this challenging case through a tailored surgical approach - combining diagnostic laparoscopy, open onlay mesh repair, and bilateral anterior component separation - emphasizes the importance of individualized treatment strategies in complex hernia cases.
4. This report serves as a call to action for further investigation into the prevalence of neurovascular complications in eTEP procedures and the potential refinement of surgical techniques to mitigate such risks.
5. The case underscores the ongoing need for vigilance and continuous improvement in minimally invasive hernia repair techniques, even as they gain popularity due to their perceived advantages.

In conclusion, this case report not only adds to the body of knowledge surrounding eTEP complications but also highlights the critical role of advanced diagnostics and personalized surgical approaches in managing complex ventral hernias. It serves as a reminder of the importance of thorough preoperative planning and the potential for unexpected complications in hernia surgery, paving the way for further research and improvement in this evolving field.