JOURNAL OF ABDOMINAL WALL SURGERY
EUROPEAN HERNIA SOCIETY

TYPE Case Report
PUBLISHED 13 November 2026
DOI 10.3389/jaws.2026.17341

Check for updates

OPEN ACCESS

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RECEIVED 09 July 2026
REVISED 25 October 2026
ACCEPTED 04 November 2026
PUBLISHED 13 November 2026

CITATION
Fortelny RH, Froehlich S and Kapitanov T (2026) Case Report: Sequential posterior and anterior intraoperative fascial traction in extreme loss-of-domain incisional hernia.
J. Abdom. Wall Surg. 5:17341.
doi: 10.3389/jaws.2026.17341

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Case Report: Sequential posterior and anterior intraoperative fascial traction in extreme loss-of-domain incisional hernia

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Background: Incisional hernias with loss of domain (LOD) following open abdomen management, visceral surgery, and cutaneous grafting present an extreme reconstructive challenge. Intraoperative fascial traction (IFT) using the Fasciotens® Abdomen device has been established as an effective adjunct to reduce fascial gaps in large ventral hernias (EHS W3). Conventional application targets the anterior rectus sheath. We describe a sequential double-layer IFT approach, first applied to the posterior and then to the anterior layer, in an extreme LOD case, and report whether posterior-layer traction allowed closure of the posterior layer without a bridging mesh.

Case Presentation: A 35-year-old male (BMI 24, DM II, nicotine abuse, polytoxicomania) presented with a massive LOD incisional hernia following polytrauma (2011) with right nephrectomy, transverse colon resection, colostomy/ileostomy, open abdomen, split-skin grafting, and a prior failed IPOM bridging repair (2021). After multimodal prehabilitation (weight reduction, drug detoxification, partial tissue expansion, and botulinum toxin A [BTA] 8 weeks preoperatively), definitive reconstruction was performed in March 2025 using a combined Rives–Stoppa/Madrid/bilateral TAR approach. IFT applied to the posterior layer for 30 min (up to 18 kg) allowed closure of this layer from the caudal margin to the umbilicus, but not in the cranial segment, where peritoneum was absent after open abdomen management and skin grafting; a bridging mesh, OviTex® S2 (30 × 25 cm, ≥5 cm overlap), was therefore placed cranially as a visceral separation layer. A second IFT phase targeting the anterior sheath (30 min) then allowed primary closure of the remaining 10-cm anterior defect. A retromuscular mesh DynaMesh®-CICAT (30 × 35 cm) was placed, and the linea alba was reconstructed using the small-bites technique (Monomax 2.0). A seroma at 6 months was aspirated once (400 mL, sterile); CT at 12 months confirmed no recurrence.

Discussion: To our knowledge, this is the first reported case of sequential posterior–anterior IFT using the Fasciotens® device. Posterior-layer traction allowed closure of the caudal posterior layer but did not avoid a bridging mesh in the cranial segment. After anterior IFT, the anterior fascia was closed primarily. Whether posterior IFT reduces the bridged area cannot be determined from a single case.

KEYWORDS
case report, Fasciotens®, incisional hernia, intraoperative fascial traction, loss of domain

Introduction

Incisional hernias with loss of domain (LOD) rank among the most complex problems in abdominal wall surgery. In these patients, herniated viscera occupy a substantial proportion of the abdominal volume, rendering simple reduction and fascial closure impossible without significant risk of abdominal compartment syndrome (ACS) [1]. This challenge is amplified when LOD results from multiple prior abdominal emergencies, open abdomen management, visceral organ resections, and cutaneous reconstruction, which collectively destroy normal tissue planes, eliminate peritoneum, and produce severe myofascial retraction.

Current strategies to achieve fascial closure in LOD hernias include preoperative botulinum toxin A (BTA) injection into the lateral abdominal wall muscles, progressive preoperative pneumoperitoneum (PPP), and intraoperative component separation techniques (CST)—specifically anterior component separation (ACS) and posterior component separation with transversus abdominis release (TAR/PCS-TAR) [2–6]. Each approach extends the reach of fascial closure but carries its own complication profile and technical complexity.

The concept of intraoperative fascial traction was first introduced by Eucker et al., who used a self-built abdominal wall expander system (AWEX) to achieve primary fascial closure in giant incisional hernias and grafted laparostomata without lateral release [7]. Intraoperative fascial traction (IFT) using the Fasciotens® Abdomen device (Thoennessen Medical Devices, Germany) has emerged as an additional tool within this armamentarium. The device exerts a controlled diagonal-anterior traction force on the rectus sheath edges, inducing viscoelastic creep of the fascial tissue and reducing the fascial gap by a mean of 9–10 cm after 30–35 min of application [8, 9]. Published series have demonstrated primary closure rates of 90%–97% when IFT is combined with BTA and, where required, CST [10]. Conventionally, Fasciotens® traction is applied to the anterior rectus sheath.

We report an extreme LOD case in which the posterior layer could not be closed after bilateral TAR. IFT was therefore first applied to the posterior layer, to examine whether traction would allow closure of this layer without a bridging mesh, and then, after posterior reconstruction, to the anterior rectus sheath. To our knowledge, this sequential application has not been described before.

Case presentation

Patient history and comorbidities

A 35-year-old male (BMI 24 kg/m^2) with diabetes mellitus type II, hyperlipidaemia, nicotine abuse (30 cigarettes/day; nicotine abstinence was achieved before definitive reconstruction), and polytoxicomania (on substitution with Compensan® and high-dose Seroquel®) presented to our unit. In March 2011, he had suffered severe polytrauma following a fall before a subway train. Injuries included pelvic ring fracture, multiple extremity fractures, post-traumatic plexus paresis of the lower extremities (left > right), haemothorax with serial rib fractures (right), bladder rupture, and right kidney rupture requiring nephrectomy. Concurrent abdominal injuries comprised splenic rupture (managed non-operatively) and rupture of the transverse colon, necessitating right hemicolectomy with end colostomy and ileostomy. Abdominal wound closure was achieved with a skin flap closure.

In June 2021, the patient was admitted with an acute abdomen caused by an incarcerated incisional hernia with small bowel gangrene. Emergency surgery included para-ileostomy management, ileo-transversostomy, and open abdomen (OA) treatment with vacuum-assisted closure (VAC). An intraperitoneal onlay mesh (IPOM) bridging repair was performed using a biological mesh. The subsequent course required mesh explantation due to infection. Final wound closure was achieved with split-skin grafting, leaving a large epigastric segment without peritoneal coverage.

Family history

Non-contributory. The loss of domain in this patient resulted from post-traumatic and postsurgical sequelae (polytrauma with visceral organ resection, subsequent open abdomen management, and recurrent incisional hernia) rather than from a hereditary connective tissue disorder or familial hernia predisposition.

Clinical findings

On repeated preoperative examination, the patient had recurrent superficial wound breakdown at the margin between native skin and the split-skin-grafted hernia sac segment; these lesions were managed conservatively with local wound therapy (hypochlorous acid solution, Granudacyn®) and healed on each occasion prior to definitive reconstruction. According to the EHS classification, the hernia was a recurrent midline incisional hernia, M1–M4, W3, with a maximum preoperative defect width of 21 cm [11].

Prehabilitation

Given the extreme complexity of this case, a structured prehabilitation program was initiated [12]. This included targeted weight reduction, a supervised drug substitution program and placement of subcutaneous tissue expanders to allow uncomplicated skin closure at the definitive repair, because the split-skin graft could not be preserved. In June 2024, four expanders were implanted (Polytech; one 800 mL expander with integrated valve in the right precostal position, and two 340 mL expanders with integrated valve and one 320 mL expander with remote valve in the right and left lower abdomen). In December 2024, an infected expander was removed from the left lower abdomen. The expanders were filled with a total of 5 L over 6 weeks. In total, three expanders required explantation because of infection of the implant pocket with *Staphylococcus* epidermidis, which could not be controlled by systemic cephalosporin therapy according to the antibiogram; the 800 mL precostal expander on the right remained *in situ* until definitive surgery. Eight weeks preoperatively, BTA (Botox®, Allergan/AbbVie, Irvine, CA, USA; 150 U per side; 300 U total) was injected bilaterally under ultrasound guidance into all three lateral abdominal wall muscles (external oblique, internal oblique, and transversus abdominis) to induce chemical myorelaxation and partial restoration of abdominal

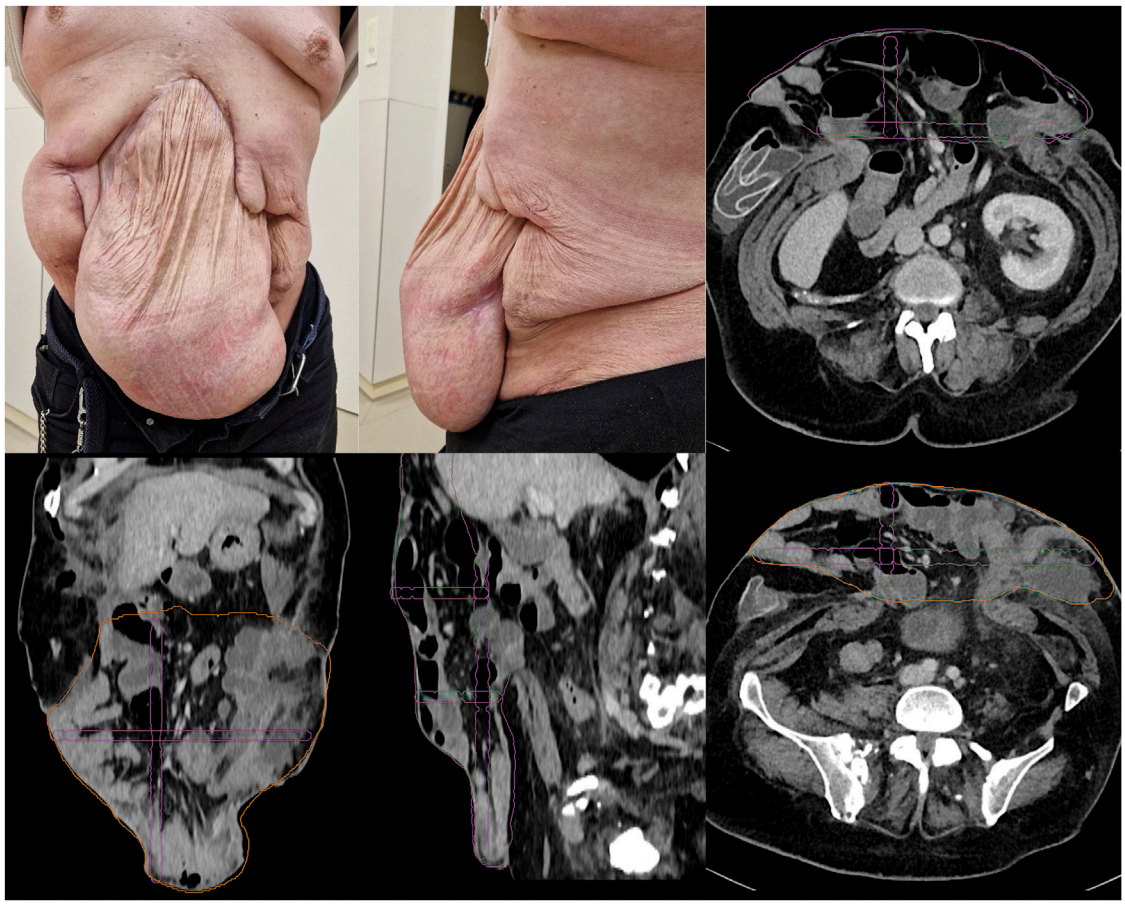


FIGURE 1
Clinical presentation and CT scan.

domain [5, 6]. This 8-week interval exceeded the conventional 2–4-week window used in most preoperative BTA protocols [5, 6], but remained within the reported duration of botulinum toxin-induced relaxation and allowed additional time for concurrent tissue-expander management and multimodal optimisation before definitive reconstruction.

Preoperative CT volumetry quantified the extent of loss of domain (Figure 1). Hernia sac volume (HSV) was calculated using the ellipsoid formula ($\pi/6 \times$ cranio-caudal $\times$ transversal $\times$ anterior-posterior) from axial and sagittal CT sections: HSV = $\pi/6 \times 28.0 \times 20.6 \times 22.0$ cm = 6,644 mL. Abdominal cavity volume (ACV) was determined analogously: ACV = $\pi/6 \times 30.0 \times 32.0 \times 20.0$ cm = 10,053 mL. The Tanaka Index (HSV/ACV) was 0.661 (threshold ≥0.25; 2.6-fold above the LOD threshold) and the Sabbagh Index (HSV/[HSV + ACV] × 100%) was 39.8% (threshold ≥20%), confirming extreme LOD by both validated CT volumetry criteria [1, 13, 14]. These indices underscored the necessity of maximal multimodal reconstruction.

Operative technique (March 2025)

The patient was positioned supine under general anaesthesia. Intraoperative intra-abdominal pressure (IAP) was measured throughout the procedure via bladder catheter.

The procedure began with explantation of the remaining tissue expander and removal of the split-skin graft, followed by extensive adhesiolysis of the small bowel. The retromuscular plane was developed using the Rives–Stoppa technique in the cranial portion of the defect [15], including pre-transversalis and pre-diaphragmatic dissection according to the Madrid modification [16, 17]. Bilateral TAR was performed from cranial to caudal to maximise myofascial advancement [3, 4, 18].

Fascial defect width was not measured at every stage. The maximum preoperative defect width was 21 cm. According to the operative report, posterior IFT allowed approximation of the posterior layer from the symphysis to the umbilicus, after which an anterior fascial defect of 10 cm remained; after anterior IFT, the anterior fascia was closed primarily. The width of the posterior-layer defect after TAR and before posterior traction was not recorded.

Due to the absence of peritoneum in the upper abdominal segment (consequence of the prior open abdomen and split-skin grafting), primary closure of the posterior layer was not achievable throughout the entire defect. The following sequential IFT strategy was therefore employed:

Step 1 – Posterior layer IFT: The Fasciotens® Abdomen device was applied to the edges of the posterior layer (Figure 2A). The traction sutures engaged the posterior rectus sheath from the

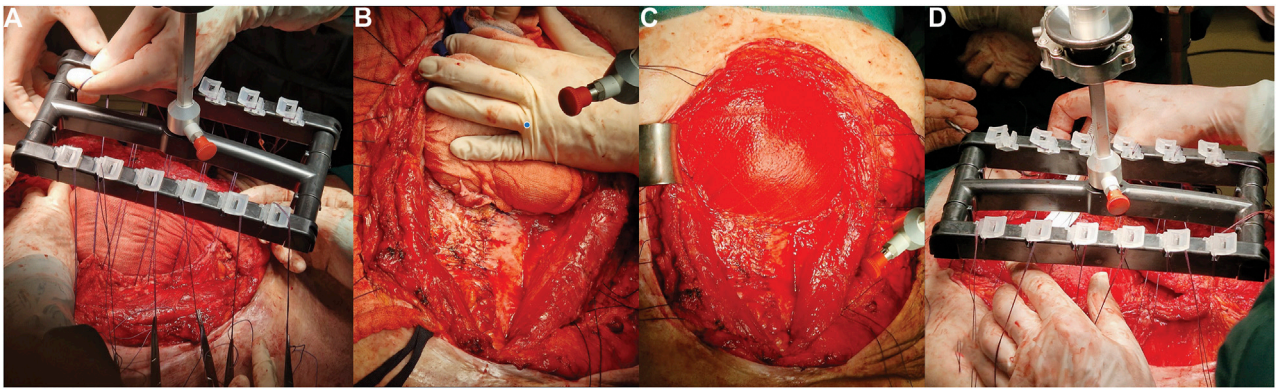


FIGURE 2
Schematic representation of sequential double-layer intraoperative fascial traction (IFT): **(A)** First IFT phase: IFT device applied to the posterior rectus sheath edge. **(B)** Caudal-to-umbilical posterior sheath closure by small bites technique. **(C)** Posterior bridging mesh (OviTex® S2) 30 × 25 cm implantation. **(D)** Second IFT phase: IFT device repositioned to the anterior rectus sheath.

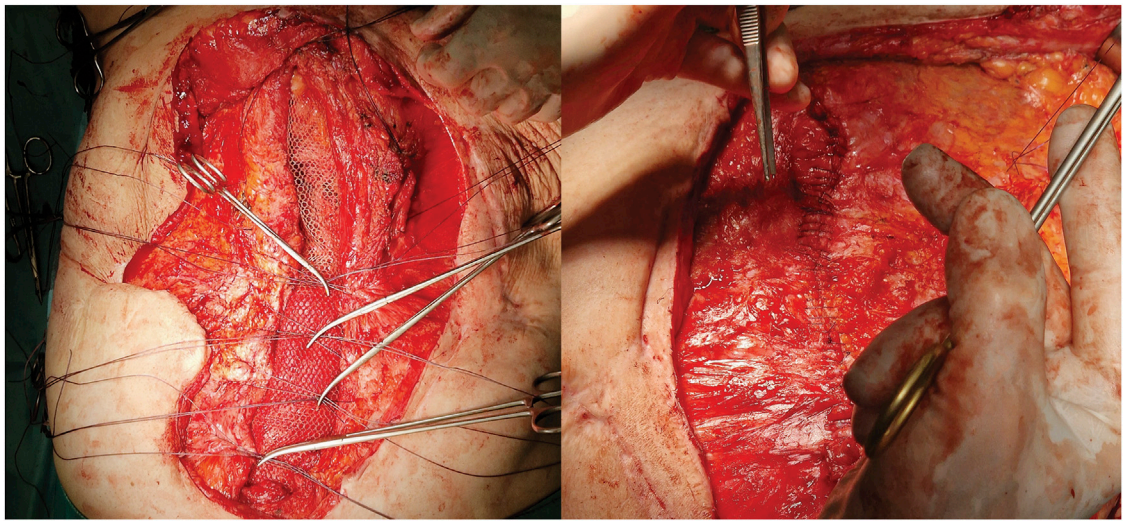


FIGURE 3
Retromuscular mesh (DynaMesh®-CICAT) 30 × 35 cm placement and complete midline closure in small bites.

caudal end of the defect to 8 cm below the xiphoid; cranial to this level, the posterior rectus sheath was kept intact according to the Madrid technique [16, 17]. No hernia sac tissue was present, because the entire area of exposed intestine had previously been covered with a split-skin graft. A controlled traction force of up to 18 kg was maintained for 30 min. This reduced the posterior fascial gap sufficiently to allow closure of the posterior layer from the caudal wound margin to the umbilicus (Figure 2B), but not in the cranial segment.

Step 2 – Cranial posterior bridging mesh reinforcement: In the epigastric segment, where the posterior sheath was absent, a posterior bridging mesh (visceral separation layer) was placed using OviTex® S2 (OviTex® 1S Permanent Reinforced Tissue Matrix, Aroa Biosurgery/Tela Bio; 30 × 25 cm) with an overlap of at least 5 cm [19]. The mesh was secured with a running suture to the borders of the posterior sheath caudally and to the diaphragmatic crura cranially (Figure 2C).

Step 3 – Anterior sheath IFT: The Fasciotens® device was repositioned and applied to the edges of the anterior rectus sheath for a further 30 min at a traction force of up to 18 kg, to address the remaining anterior defect of 10 cm. Following fascial creep, primary closure of the anterior fascia was achieved (Figure 2D).

Step 4 – Retromuscular mesh: A DynaMesh®-CICAT mesh (30 × 35 cm; PVDF monofilament; FEG Textiltechnik, Aachen, Germany) was placed in the retrorectus/retromuscular position to reinforce the repair (Figure 3).

Step 5 – Linea alba closure: The midline was closed using the small-bites technique with Monomax® 2.0 monofilament suture (B. Braun Surgical, Melsungen, Germany), as recommended for

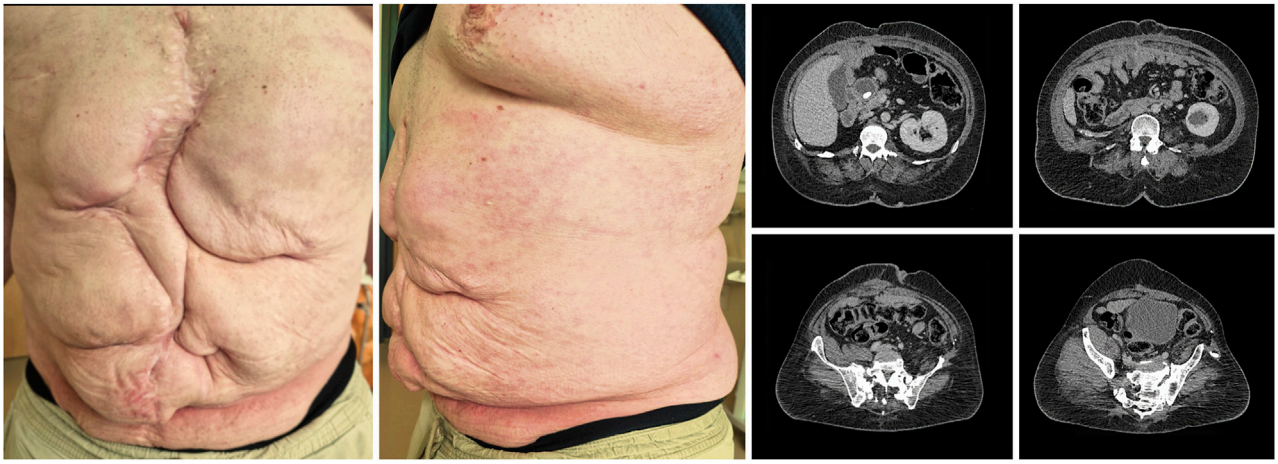


FIGURE 4
12-month postop. Clinical presentation and CT scan.

primary fascial closure to reduce wound healing complications (Figure 3) [20–22].

Step 6 – Wound management: After skin excision of the prior graft area, wound closure was reinforced with negative pressure wound therapy (NPWT) applied to the closed incision [23].

Postoperative course and follow-up

Clinician-assessed outcomes

The patient was extubated 24 h after surgery and stayed 2 days in the intermediate care unit. IAP remained below 12 mmHg during the 48 h of postoperative monitoring, with no signs of abdominal compartment syndrome. NPWT was removed on postoperative day 4, and the wound healed primarily. The patient was discharged on postoperative day 10. The only complication was a seroma requiring a single percutaneous aspiration (see below; Clavien–Dindo grade I). There was no readmission and no reoperation. Follow-up visits took place at 14 days and at 3, 6 and 12 months, with CT at 6 and 12 months. At 12 months, the abdominal wall was clinically stable without palpable recurrence, with a cosmetically acceptable result (Figure 4).

Important follow-up results

CT at 6 months showed a seroma 1.5 cm thick and 20 cm in diameter, which was aspirated percutaneously on 27 October 2025 (400 mL); the culture showed no bacterial growth. CT at 12 months (30 April 2026) showed an intact reconstruction without recurrent incisional hernia, mesh migration or residual seroma (Figure 4).

Patient-assessed outcomes

The patient reported resolution of chronic back pain, improved mobility and the ability to sit for prolonged periods (see 3.1 Patient perspective). No validated quality-of-life instrument (e.g., SF-36) was used; the patient confirmed his satisfaction with the result, in particular the marked improvement in mobility.

Adherence and tolerability

BTA injection was well tolerated without adverse effects. The patient continued the substitution programme and maintained nicotine abstinence after surgery. An abdominal binder was worn for 4 weeks.

Adverse and unanticipated events

During prehabilitation, three tissue expanders had to be removed because of infection, and recurrent superficial wound breakdown at the margin of the skin graft was managed conservatively. No intraoperative complications occurred. Apart from the seroma described above, no postoperative adverse or unanticipated events occurred.

Discussion

This case report documents an extreme LOD incisional hernia resulting from a cascade of abdominal catastrophes spanning 14 years—polytrauma, emergency visceral surgery, open abdomen, skin grafting, and repeated hernia repair failure. The final operative solution required the integration of multiple contemporary techniques, including BTA prehabilitation, the Rives–Stoppa procedure, the Madrid modification of posterior component separation, bilateral TAR, and IFT with Fasciotens®.

The defining innovation of this case was the sequential application of IFT at two distinct fascial layers. IFT with the Fasciotens® Abdomen device exploits the viscoelastic properties of fascial tissue. When a sustained, measured traction force (≥10 kg for 30–35 min) is applied, the fascial matrix undergoes stress relaxation and creep, resulting in permanent elongation of the sheet without structural disruption [8, 9]. All published series to date have applied this principle exclusively to the anterior rectus sheath, where the traction arms grip the fascial edge and pull anteriorly and diagonally. The single earlier report in which the device engaged the posterior fascial plane at all was an open-

abdomen case, in which a mesh bridging both the posterior and anterior fascia was traction-loaded as one combined unit rather than through two discrete, layer-specific applications [24]. Independent, staged traction of the posterior sheath as a distinct intraoperative step, as performed in the present case, has, to our knowledge, not been previously described.

In the present case, the standard anatomy was profoundly altered. Bilateral TAR alone was insufficient to close the posterior layer across the entire defect length because the severe lateral muscle retraction after years of OA management had reduced the effective myofascial length. After 30 min of posterior IFT, the posterior layer could be closed from the caudal wound margin to the umbilicus. Posterior IFT did not, however, achieve closure of the posterior layer without bridging: in the cranial segment, a bridging mesh of OviTex® S2 (≥5 cm overlap) was still required to provide visceral separation. In this segment, the limiting factor was not only the width of the gap but the absence of peritoneum and posterior sheath after OA management and skin grafting, a tissue deficit that traction cannot replace. Because the width of the posterior-layer defect before traction was not recorded, it cannot be determined how much posterior IFT reduced the extent of the bridged area. The present case therefore shows that posterior IFT is feasible, but not that it avoids bridging of the posterior layer.

The second IFT phase, targeting the anterior sheath, then addressed the remaining fascial gap at the outer layer. This sequential strategy is conceptually analogous to the layered closure principle in complex wound management: each layer is mobilised and closed independently before the next is addressed. Conventional traction on the anterior rectus sheath alone did not appear feasible because of the size of the defect, even after bilateral TAR. IFT was therefore first applied to the posterior layer and, after successful approximation of this layer from the symphysis to the umbilicus, to the anterior sheath, where a defect of 10 cm remained. In addition, after Rives–Stoppa dissection and TAR the two layers are separated, so that traction on the anterior sheath does not approximate the posterior layer, and the posterior layer had to be closed and the cranial bridge placed before the retromuscular mesh could be positioned. Whether separate phases offer a mechanical advantage over simultaneous traction cannot be judged from a single case.

In published series, IFT reduced the fascial gap by a mean of about 10 cm and allowed closure in 90% of W3 hernias; combined with BTA, additional TAR was required in 30% of patients [9, 10]. The present case differed from these series by the loss of peritoneum in the cranial segment, multi-plane adhesions and previous biological mesh explantation. Preoperative BTA reduces the need for component separation in large incisional hernias [5, 6]. In this patient, BTA was one element of the multimodal preparation; its individual contribution cannot be determined from a single case.

The Madrid modification of PCS-TAR used in the subxiphoid portion of this case extends the standard retrorectus plane by preserving the posterior sheath intact and developing a preperitoneal dissection anterior to the transversalis fascia, including pre-diaphragmatic dissection for subdiaphragmatic defects [16, 17]. This approach is essential when the cranial extent of the defect approaches or involves the xiphoid, as in the present case, providing the space necessary for adequate mesh overlap at the superior border.

IAP monitoring throughout the procedure and for 48 postoperative hours was critical. Restoration of abdominal domain in LOD hernias carries an inherent risk of raised IAP and ACS. IAP remained within safe limits in our patient, consistent with the thorough preoperative preparation and the incremental nature of the reconstruction. The Tanaka Index, computed from preoperative CT, provides a validated quantitative measure of domain loss and may guide selection of preoperative optimisation intensity [1]. Preoperative CT volumetry in our patient (Tanaka Index 0.661, Sabbagh Index 39.8%; see section *Prehabilitation*) confirmed extreme LOD and justified the maximal multimodal strategy [13, 14].

The choice of OviTex® S2 for the cranial posterior bridging mesh segment reflects the need for a biologically compatible, reinforced tissue matrix in a contaminated-adjacent field with no native peritoneum. Biologic or biocomposite meshes are preferred in such reconstructions to reduce the risk of mesh infection and to allow tissue ingrowth in the absence of a peritoneal layer [19].

The infection of three tissue expanders during prehabilitation raised the risk of mesh infection at the definitive repair. The implant-pocket infections (*Staphylococcus* epidermidis) could not be controlled by systemic cephalosporin therapy according to the antibiogram and required explantation of the affected expanders. Reconstruction was performed 4 weeks after the last explantation, once the infection had resolved. The remaining expander was removed at the beginning of the operation and its capsule excised; because there were no signs of infection, no swabs were taken. A macroporous PVDF mesh was placed in the retromuscular position, and a reinforced tissue matrix was chosen for the cranial posterior bridge. No mesh-related infection occurred during 12 months of follow-up, and the aspirated seroma was sterile. Nevertheless, infected expanders should be regarded as a risk factor for mesh infection, and their role in prehabilitation for LOD hernia repair should be weighed against this risk.

Strengths and limitations

This report documents abdominal wall reconstruction in a patient with extreme loss of domain (Tanaka Index 0.661), a previous failed repair and severely altered tissue planes after open abdomen management and split-skin grafting. Its strengths are the description of a layer-specific, sequential application of IFT to the posterior and then the anterior layer, which extends the technique beyond conventional anterior-layer traction; the quantitative characterisation of loss of domain by preoperative CT volumetry; the stepwise operative description with photographs; perioperative IAP monitoring; clinical and CT follow-up at 12 months; and the patient's perspective on functional outcome. The limitations are those of a single case. Generalisability is restricted, and whether the outcome reflects the dual-layer technique itself, the combination with BTA or the extensive TAR dissection cannot be determined. Posterior IFT did not avoid a bridging mesh in the cranial segment. Fascial defect width was not measured at every stage: the maximum

preoperative width (21 cm) and the residual anterior defect before anterior traction (10 cm) are reported, but the width of the posterior-layer defect before and after posterior traction was not recorded; the additional approximation achieved by posterior traction, and whether it reduced the extent of cranial bridging, therefore cannot be quantified. Intra-abdominal and plateau airway pressures before and after fascial closure were not documented, so the physiological effect of restoring the abdominal domain cannot be quantified. Future reports of sequential IFT should measure the width and length of the fascial gap at each phase and the traction force applied. No validated quality-of-life instrument was used. Finally, smoking cessation in this patient with previous heavy nicotine use (30 cigarettes/day) was not supported by a structured smoking-cessation programme.

Patient perspective

Before surgery, the patient had lost hope that his condition could improve. Postoperatively, he describes himself as immensely grateful, reporting a markedly better quality of life: his chronic back pain has resolved, and despite his pre-existing lower-limb impairment he can now move considerably more freely and sit for prolonged periods without difficulty. These functional gains have made vocational retraining feasible, with eventual reintegration into the workforce anticipated, and he is due to be married in the near future. In his own words, a new chapter of his life has begun.

Conclusion

Sequential posterior and anterior intraoperative fascial traction with the Fasciotens® Abdomen device was feasible in this case of extreme LOD. Posterior IFT allowed closure of the posterior layer from the caudal margin to the umbilicus, but did not avoid a bridging mesh in the cranial segment, where peritoneum was absent. After anterior IFT, the anterior fascia was closed primarily, and the reconstruction remained intact at 12 months. This single case therefore does not show that posterior IFT can replace bridging of the posterior layer. Prospective series with measurement of the fascial gap at each phase are needed to determine whether posterior IFT reduces the extent of bridging and in which patients it allows complete posterior closure.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Wiener Gesundheitsverbund, Ethikkommission. The studies were conducted in accordance with the local legislation and institutional requirements. The ethics committee/institutional review board waived the requirement of written informed consent for participation from the participants or the participants' legal guardians/next of kin because only case report, no ethical vote necessary. Written informed consent was obtained from the individual for the publication of any potentially identifiable images or data included in this article.

Author contributions

RF: conception, surgical technique, manuscript drafting and revision. SF and TK: manuscript drafting and revision. All authors contributed to the article and approved the submitted version.

Funding

The author(s) declared that financial support was not received for this work and/or its publication.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontierspartnerships.org/articles/10.3389/jaws.2026.17341/full#supplementary-material

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