

First Case of Internal Hernia After Revision of Biliopancreatic Diversion (Ceriani Procedure): A Case Report

Ann. Ital. Chir., 2025 96, 10: 1286–1289
<https://doi.org/10.62713/aic.3404>

Gianmarco Panzera¹

¹Department of General Surgery, Università Cattolica del Sacro Cuore – Fondazione Policlinico Universitario A. Gemelli IRCCS, 00168 Roma, Italy

AIM: To document the first known case of internal hernia following the Ceriani Procedure (CP) and evaluate its clinical and surgical management.

CASE PRESENTATION: A 57-year-old female with a history of biliopancreatic diversion (BPD) underwent CP for inadequate weight loss. She presented one year later with acute abdominal pain and fever. Diagnostic imaging and laparoscopy confirmed an internal hernia. Treatment involved lysis of adhesions, hernia reduction, and closure of mesenteric defects. The patient had an uneventful recovery and remained symptom-free during follow-up.

RESULTS: The patient presented with acute abdominal pain and fever one year after undergoing the CP. Laboratory tests revealed elevated white blood cell count (11,780/mm³) and lactate levels (3.6 mmol/L), with normal inflammatory markers. CT imaging showed signs of small bowel obstruction and a swirl sign consistent with internal hernia. Emergency laparoscopy confirmed herniation through an inframesenteric defect. The procedure was converted to open laparotomy for safe hernia reduction and mesenteric defect closure. The patient recovered without complications and was discharged on postoperative day three. At follow-up, she remained symptom-free.

CONCLUSIONS: Internal hernia is a potential complication after CP, similar to Roux-en-Y reconstructions. Prompt diagnosis and surgical intervention are critical to avoiding severe complications like bowel infarction.

Keywords: internal hernia; Ceriani Procedure; biliopancreatic diversion; bariatric surgery complications; revision surgery; small bowel obstruction; case report

Introduction

Internal hernia is a recognized complication of bariatric surgery, with a reported incidence ranging from 1% to 6% following Roux-en-Y gastric bypass (RYGB) procedures [1]. These hernias result from anatomical changes in the mesentery, particularly after significant weight loss, leading to the development of mesenteric defects. If untreated, internal hernias can cause life-threatening complications such as bowel obstruction and ischemia.

The Ceriani Procedure (CP), introduced in 2017, is a novel surgical approach designed to address the limitations of biliopancreatic diversion (BPD), including inadequate weight loss, chronic diarrhea, and proctologic complications. CP involves creating a small gastric pouch and elongating the common channel to achieve better weight regulation and symptom relief [2]. Despite its benefits, CP is anatomically similar to RYGB, and the potential for complications such as internal hernia remains underexplored.

The classification of internal hernias remains a topic of debate. The Space-Direction-Limb (SDL) classification system integrates key elements from the Meyer and Tucker classifications, offering a comprehensive framework for understanding the pathophysiology and facilitating communication between bariatric and non-bariatric specialists [3]. However, the diagnosis and management of internal hernias post-bariatric surgery remain significant clinical challenges [4].

This case report presents the first documented instance of internal hernia following CP, emphasizing the importance of recognizing this complication in post-CP patients. It highlights the clinical presentation, diagnostic challenges, and surgical management, contributing valuable insights to the growing body of literature on bariatric surgery complications. This case has been reported in line with the Case Report (CARE) Guidelines to ensure the accuracy and completeness of the report (**Supplementary Material**) [5].

Case Presentation

A 57-year-old female presented to the Emergency Department in 2021 with severe abdominal pain and fever. She reported that the pain, localized to the left upper quadrant and mesogastrium, had been progressively worsening throughout the day. She denied nausea, vomiting, diarrhea, or constipation and reported normal bowel movements and urina-

Submitted: 6 May 2024 Revised: 13 January 2025 Accepted: 15 January 2025 Published: 4 September 2025

Correspondence to: Gianmarco Panzera, Department of General Surgery, Università Cattolica del Sacro Cuore – Fondazione Policlinico Universitario A. Gemelli IRCCS, 00168 Roma, Italy (e-mail: gianmarco.panzera01@icatt.it).

tion. She also denied any recent trauma, dietary triggers, or other inciting events.

The patient underwent BPD in 2012 for morbid obesity, with an initial body mass index (BMI) of 52 kg/m². Although the procedure resulted in some weight loss, it was insufficient, and she experienced significant complications, including proctologic sequelae and chronic diarrhea. By 2020, her BMI was 43.5 kg/m², prompting revision surgery with the CP to address her inadequate weight loss and gastrointestinal symptoms. Following CP, her BMI improved to 30.41 kg/m² by 2021.

The patient had a surgical history of BPD in 2012 and CP in 2020. Her family history was non-contributory, with no known cases of obesity, diabetes, or metabolic disorders. Socially, she led a sedentary lifestyle and had a diet high in processed foods, although she attempted to modify her diet following surgery. She denied any alcohol use, smoking, or substance abuse.

Upon examination in 2021, the patient exhibited abdominal distension and tenderness to palpation, primarily in the left upper quadrant and mesogastrium. There were no signs of rebound tenderness, guarding, or rigidity. Vital signs included a blood pressure of 128/90 mmHg, heart rate of 96 bpm, temperature of 37.8 °C, oxygen saturation (SpO₂) of 100%, and a Glasgow Coma Scale (GCS) score of 15, indicating full consciousness [6]. Laboratory investigations revealed an elevated white blood cell (WBC) of 11,780/mm³ (normal range: 4000–10,000/mm³), indicating a potential inflammatory or stress response. Her metabolic panel showed lactate levels of 3.6 mmol/L (normal: 0.5–2.2 mmol/L), suggesting hypoperfusion or ischemia, while potassium (4 mmol/L) and sodium (137 mmol/L) levels were within normal limits. Inflammatory markers, including C-reactive protein (CRP) and procalcitonin (PCT), were negative, suggesting the absence of systemic infection or sepsis. Arterial blood gas analysis showed a pH of 7.44, a PaCO₂ of 38 mmHg and a HCO₃[−] of 25 mEq/L, consistent with normal acid-base status.

A computed tomography (CT) scan of the abdomen and pelvis with intravenous contrast was performed using a SOMATOM Definition AS 64 CT scanner (64-slice, Siemens Healthineers, Erlangen, Bavaria, Germany), revealing findings consistent with bowel obstruction. Key observations included gas distension of the ileal loops in the mesogastrium and left flank, with an abrupt “jump in caliber” at a loop in the mesogastrium, suggestive of torsion (Fig. 1A). The mesenteric vessels exhibited a “vortex” appearance of the ileocolic vessels (swirl sign), diagnostic of an internal hernia (Fig. 1B). Surrounding tissues showed fluid imbibition of the adjacent adipose tissue and multiple subcentimetric reactive mesenteric lymph nodes. The bowel lumen had a maximum diameter of approximately 4 cm, with multiple hydro-air levels in the upstream loops.

The patient’s timeline of events included undergoing BPD in 2012, which resulted in inadequate weight loss and gas-

trointestinal symptoms. In 2020, she underwent revision surgery with CP to address weight regain and proctologic sequelae (BMI: 43.5 kg/m²). By 2021, her BMI had improved to 30.41 kg/m², and she presented with acute abdominal pain and fever, with a diagnosis of internal hernia. Upon diagnostic confirmation of an internal hernia via CT imaging, the patient was prepared for emergency surgical intervention. Pre-operative preparations included fasting, intravenous fluid resuscitation, and antibiotic prophylaxis to mitigate the risks of infection. The surgical procedure commenced with diagnostic laparoscopy, revealing a small bowel obstruction caused by herniation through an inframesenteric defect. Given the extent of bowel distension, the procedure was converted to an open laparotomy for enhanced visualization and safer manipulation of the bowel. The herniated bowel loop was carefully reduced, and adhesions were lysed to free the bowel and restore normal anatomy. To prevent recurrence, the mesenteric defect was meticulously closed using interrupted non-absorbable sutures. Hemostasis was ensured throughout the procedure, and the bowel was inspected for signs of ischemia. Fortunately, no bowel resection was required as the herniated segment was viable.

Post-operatively, the patient was closely monitored in the surgical ward for signs of complications such as infection or recurrent obstruction. She received intravenous fluids, analgesics, and prophylactic anticoagulants to prevent venous thromboembolism. A gradual return to oral intake was initiated, starting with clear liquids and progressing to a soft diet over several days. The patient showed significant improvement and was discharged on the third post-operative day with instructions for dietary modifications and activity restrictions. At the two-week follow-up, she reported no further complications and had resumed normal activities.

The patient was informed about the nature of the surgery and the risks of complications. She was satisfied with the management of her condition and the outcome of the intervention. Written informed consent was obtained from the patient for the publication of this case report and any accompanying images. Since, this study is not a clinical trial, ethical approval was not required.

Discussion

Internal hernia is a well-recognized late complication of bariatric surgeries, particularly RYGB. This case report documents the first known instance of internal hernia following the CP, a novel surgical technique designed to address complications such as insufficient weight loss and chronic diarrhea after BPD. Despite its distinct anatomical alterations, CP shares similarities with RYGB that predispose patients to internal hernias, including the creation of mesenteric defects and changes in bowel orientation.

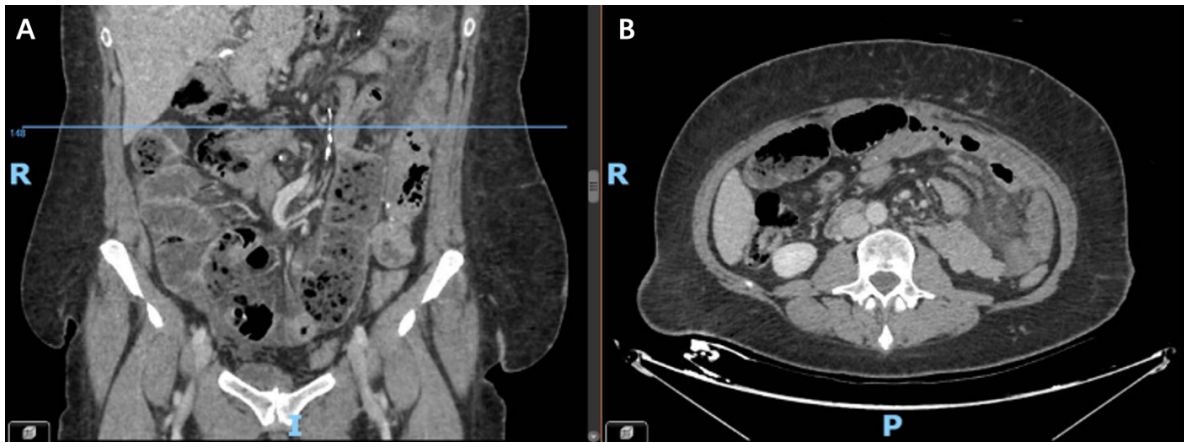


Fig. 1. Abdominal computed tomography (CT) scan findings (internal hernia). (A) Axial view showing abrupt transition point (highlighted by a blue line) with proximal small bowel dilation, suggestive of mechanical obstruction. (B) Swirl sign: torsion of mesenteric vessels creating a whirlpool-like appearance, pathognomonic for internal hernia. R, right; P, posterior; I, inferior.

Incidence and Risk Factors

Small bowel obstruction is a typical post-operative complication after bariatric surgery and ranges from 1 to 6%, almost 60%, is due to internal hernia. The most common location of internal hernia is the meso-jejunal mesenteric window (56%), followed by Petersen's window (27%), and the mesocolic window (17%) [7]. Most of them appeared after changes in the mesentery anatomy due to maximal weight loss [8]. According to Paroz A *et al.* [9], the true incidence of this complication is generally underestimated, mainly because the duration of the follow-up is limited and the mean development of symptomatic internal hernia is 28.8 months. CP is designed to treat invalidating proctologic sequelae or insufficient weight loss after BPD through the elongation of the common channel that implies a tendency towards possible weight regain [10]. Therefore, it has been associated to a gastric resection, the resulting procedure consists of a gastric pouch of 40 mL and a total in continuity small bowel limb of 250 cm with a common channel of 200 cm. Results showed a significant reduction in bowel movements.

As in this case CP was indicated for unsatisfactory weight loss after BPD. One year later the patient had lost almost 35 kg: weight 74 kg-BMI 30.41 kg/m² from 106 kg-BMI 43.50 kg/m². Afterwards, the patient presented with severe abdominal pain and fever, indicative of bowel obstruction caused by an internal hernia. The CT scan demonstrated the classic "swirl sign" of mesenteric vessel torsion, which, along with clinical findings, led to a timely surgical intervention. Although the swirl sign remains a valuable diagnostic clue, the intermittent nature of symptoms often complicates preoperative diagnosis, underscoring the importance of clinical vigilance.

Clinical Observations

One notable finding in this case was the elevated WBC count and lactate levels, with normal CRP and PCT. El-

evated lactate is indicative of tissue hypoperfusion or ischemia, a hallmark of internal hernias, whereas the absence of inflammatory markers like CRP suggests localized pathology rather than systemic inflammation. This pattern highlights the diagnostic utility of lactate in cases where traditional inflammatory markers are inconclusive.

The anatomical changes introduced by CP, including elongation of the common channel and reduction of the gastric pouch, aim to address specific complications of BPD [11]. However, the procedure also introduces new risks, as significant weight loss following CP can contribute to the development of mesenteric defects. This case demonstrates that even well-established bariatric techniques can lead to complications if underlying risk factors are not adequately managed.

Lifestyle and Environmental Factors

The potential role of lifestyle factors, such as dietary habits, in the development of internal hernias warrants further investigation. Post-surgical weight loss, while beneficial, may predispose certain patients to anatomical vulnerabilities. A tailored approach to postoperative care, including dietary counseling and routine imaging for high-risk patients, could help mitigate these risks.

Management and Outcomes

Management of internal hernias often requires prompt surgical intervention due to the risks of bowel infarction and necrosis. In this case, laparotomy allowed for reduction of the hernia and closure of the mesenteric defect, resulting in a favorable outcome. This underscores the critical role of timely diagnosis and surgical expertise in preventing severe complications. The patient's uneventful recovery and improved quality of life highlight the success of the chosen therapeutic approach.

Future Directions

This case underscores the need for long-term follow-up and monitoring in patients undergoing CP and similar bariatric procedures. Future studies should focus on identifying specific risk factors for internal hernias, optimizing surgical techniques to minimize mesenteric defects, and exploring the role of routine imaging in early detection. Enhanced classification systems, such as the SDL classification, could improve communication between bariatric and non-bariatric healthcare providers, facilitating better diagnosis and management.

This case report contributes valuable insights into the complexities of CP and its potential complications. It emphasizes the importance of clinical awareness, patient-specific risk assessment, and multidisciplinary collaboration in managing post-bariatric surgery complications.

Conclusions

Rapid surgical treatment is key to preventing bowel infraction necessitating resection. Presentation of bowel obstruction due to internal hernia in a patient with a history of previously bariatric surgery is variable. CT scans and physical examination may be helpful in identifying key findings, such as the transition point, swirl sign, and pain in the left upper quadrant. Most of the time, the definitive diagnosis is made intraoperatively during emergency surgical exploration for “acute abdominal pain”. CP, like classical RYGB reconstruction, may lead to internal hernias. Physicians should be aware of these post-operative conditions in order to achieve a prompt management.

Availability of Data and Materials

All data and materials related to this case report are included in the manuscript and are available upon request from the corresponding author.

Author Contributions

GP is the sole author and is fully responsible for the study's conception, data collection and analysis, manuscript preparation, and overall integrity of the work.

Ethics Approval and Consent to Participate

This study is a case report and did not require approval from an ethics committee. Written informed consent was obtained from the patient for publication of this case report and any accompanying images. This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Acknowledgment

The author would like to thank the Fondazione Policlinico Universitario A. Gemelli IRCCS for providing the clinical and surgical support necessary for the management of this case.

Funding

This research received no external funding.

Conflict of Interest

The author declares no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.62713/ai.c.3404>.

References

- [1] Contival N, Menahem B, Gautier T, Le Roux Y, Alves A. Guiding the non-bariatric surgeon through complications of bariatric surgery. *Journal of Visceral Surgery*. 2018; 155: 27–40. <https://doi.org/10.1016/j.jvisc.2017.10.012>.
- [2] Ceriani V, Pinna F, Lodi T, Pontiroli AE. Revision of Biliopancreatic Diversion for Side Effects or Insufficient Weight Loss: Codification of a New Procedure. *Obesity Surgery*. 2017; 27: 1091–1097. <https://doi.org/10.1007/s11695-017-2575-z>.
- [3] Tucker ON, Escalante-Tattersfield T, Szomstein S, Rosenthal RJ. The ABC System: a simplified classification system for small bowel obstruction after laparoscopic Roux-en-Y gastric bypass. *Obesity Surgery*. 2007; 17: 1549–1554. <https://doi.org/10.1007/s11695-007-9273-1>.
- [4] Geubbels N, Lijftogt N, Fiocco M, van Leersum NJ, Wouters MWJM, de Brauw LM. Meta-analysis of internal herniation after gastric bypass surgery. *The British Journal of Surgery*. 2015; 102: 451–460. <https://doi.org/10.1002/bjs.9738>.
- [5] Gagnier JJ, Kienle G, Altman DG, Moher D, Sox H, Riley D, *et al*. The CARE guidelines: consensus-based clinical case report guideline development. *Journal of Clinical Epidemiology*. 2014; 67: 46–51. <https://doi.org/10.1016/j.jclinepi.2013.08.003>.
- [6] Matis G, Birbilis T. The Glasgow Coma Scale—a brief review. Past, present, future. *Acta Neurologica Belgica*. 2008; 108: 75–89.
- [7] Karcz WK, Zhou C, Daoud M, Gong Z, Blazeczyk K, Keck T, *et al*. Modification of internal hernia classification system after laparoscopic Roux-en-Y bariatric surgery. *Wideochirurgia i Inne Techniki Maloinwazyjne = Videosurgery and other Miniinvasive Techniques*. 2015; 10: 197–204. <https://doi.org/10.5114/wiitm.2015.52160>.
- [8] Meyer A, Nowotny K, Poeschl M. Internal hernias of the ileocecal region. *Ergebnisse Der Chirurgie Und Orthopädie*. 1963; 44: 176–204.
- [9] Paroz A, Calmes JM, Giusti V, Suter M. Internal hernia after laparoscopic Roux-en-Y gastric bypass for morbid obesity: a continuous challenge in bariatric surgery. *Obesity Surgery*. 2006; 16: 1482–1487. <https://doi.org/10.1381/096089206778870102>.
- [10] Scopinaro N, Marinari G, Camerini G, Papadia F, 2004 ABS Consensus Conference. Biliopancreatic diversion for obesity: state of the art. *Surgery for Obesity and Related Diseases: Official Journal of the American Society for Bariatric Surgery*. 2005; 1: 317–328. <https://doi.org/10.1016/j.soard.2005.03.216>.
- [11] Levine MS, Carucci LR. Imaging of bariatric surgery: normal anatomy and postoperative complications. *Radiology*. 2014; 270: 327–341. <https://doi.org/10.1148/radiol.13122520>.

© 2025 The Author(s).

