

Unreported rare but serious complication: Major vascular injuries during bariatric surgery

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ABSTRACT

BACKGROUND: The aim of this study was to investigate the incidence, risk factors, clinical presentation, and management of major vascular injuries during bariatric surgery, with a specific focus on the role of different access methods in abdominal cavity entry.

METHODS: A nationwide survey was conducted among bariatric surgeons to assess the prevalence of major vascular injuries. A questionnaire was distributed to 365 surgeons through WhatsApp groups of two national bariatric surgery societies, with 76 surgeons completing the survey. The study population included general surgeons practicing bariatric surgery, and the questionnaire consisted of 12 questions.

RESULTS: Among the participants, 16.9% reported experiencing a major vascular injury during bariatric surgery. The majority of injuries (75%) occurred at the trocar entrance, with the remaining cases during the dissection phase. Notably, 66.7% of surgeons used optical trocars for access, while 27.8% employed the Veress needle technique. Early detection varied, with 45% identifying the injury immediately and 30% recognizing it within three minutes. Most injuries (52.4%) were repaired laparoscopically, and only three surgeons sought assistance from cardiovascular surgeons.

CONCLUSION: Vascular injuries are infrequent but potentially serious complications in laparoscopic bariatric surgery. Understanding their incidence, timely recognition, and proper management are crucial to minimize adverse effects. The findings of this study shed light on the patterns of vascular injuries and the potential role of specific access methods, providing valuable insights for enhancing patient safety in bariatric surgery.

Keywords: Bariatric surgery; major vascular injury; obesity.

INTRODUCTION

Bariatric surgery has emerged as an effective treatment for morbid obesity, offering significant weight loss and improvement in obesity-related comorbidities. However, like any surgical procedure, bariatric surgery is not without risks. One potential complication that can occur is major vascular injury, which refers to the disruption or damage to major blood vessels during the surgical intervention. While major vascular injuries are relatively rare in bariatric surgery, they can have severe consequences if not promptly recognized and managed. These injuries can lead to significant bleeding, hemodynamic instability, and organ ischemia, potentially resulting in

prolonged hospital stays, increased blood transfusion requirements, the need for intensive care unit (ICU) admission, and even mortality. Therefore, understanding the incidence, risk factors, clinical presentation, and management of major vascular injuries is essential for bariatric surgeons to ensure optimal patient outcomes. In this study, we will explore the current literature and discuss the limitations and challenges associated with major vascular injury in bariatric surgery. The incidence of vascular injury in bariatric surgery can vary worldwide, and providing an exact prevalence rate is challenging due to variations across different countries, health-care institutions, and surgical centers. A study reported a vascular injury rate of 0.8% among 1573 obese patients who underwent laparo-

Cite this article as: Aktokmakyán TV, Peksen C, Savař OA, Sumer A. Unreported rare but serious complication: Major vascular injuries during bariatric surgery. *Ulus Travma Acil Cerrahi Derg* 2023;29:1255-1260.

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Ulus Travma Acil Cerrahi Derg 2023;29(11):1255-1260 DOI: 10.14744/tjtes.2023.71829 Submitted: 21.08.2023 Revised: 12.09.2023 Accepted: 19.09.2023
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scopic gastric bypass surgery.^[1] Another study stated that the incidence of vascular injury in bariatric surgery ranged from 0.28% to 1.6%.^[2] In the context of bariatric surgery, risk factors encompass a range of variables such as patient demographics, comorbidities, surgical techniques, and anatomical considerations that may contribute to the occurrence of major vascular injuries. The aim of this nationwide survey is to investigate the safety of different types of access to abdominal cavity during bariatric surgery. The identified cases were analyzed for patient characteristics, surgical details, type of vascular injury, management strategies, and outcomes.

MATERIALS AND METHODS

The questionnaire was sent to approximately 365 bariatric surgeons in the WhatsApp groups of two national bariatric surgery societies (TSMBS and TOSS). A total of 76 (20.8%) bariatric surgeons completed the electronic questionnaire. This cross-sectional study was conducted through an online, anonymous, self-administered structured questionnaire. The survey was designed using Google Forms and included general surgeons practicing bariatric surgery. The questionnaire was developed in consultation with a group of experts in bariatric surgery at the Department of General Surgery at İstinye University Gaziosmanpaşa Hospital and consisted of 12 mandatory questions (Table 1). This study was conducted in accordance with the principles of the Helsinki Declaration and received approval from the Human Ethics Committee of İstinye University School of Medicine.

Statistical Analysis

Our study includes analysis of survey-based data. All data were stored after coding in Excel format and analyzed again using Excel (Microsoft Corp. microsoft office 2021v. excel)

Table 1. Questions of the questionnaire

Questionnaire

Your general surgery specialization period
 Number of bariatric surgeries performed in 1 month
 Did you experience a major vascular injury during bariatric surgery?
 Which vascular structure injuries have you experienced?
 At what stage did you experience vascular injury?
 If the injury you experienced was the first trocar entry, which method did you use?
 What is the exact minute did you detect the injury?
 How did you manage the injury ?
 How long did the patient stay in the hospital?
 Have you requested assistance from the cardiovascular surgery clinic for vascular repair?
 Did you continue the planned bariatric surgery after the injury?
 Did you have any mortality?

program. Since no comparison was made in this study, analytical analyses were not performed, only descriptive statistics were given. Categorical data were examined by giving percentages and rates. Hospitalization times and surgery times were analyzed by giving minimum and maximum values.

RESULTS

A total of 76 (20.8%) participants completed the questionnaire. The experience period of the surgeons included in the study was 5.7% for 0–5 years, 11.4% for 6–10 years, 24.3% for 11–15 years, 24.3% for 16–20 years, and 34.3% for 21 and above. The number of operations performed during a month

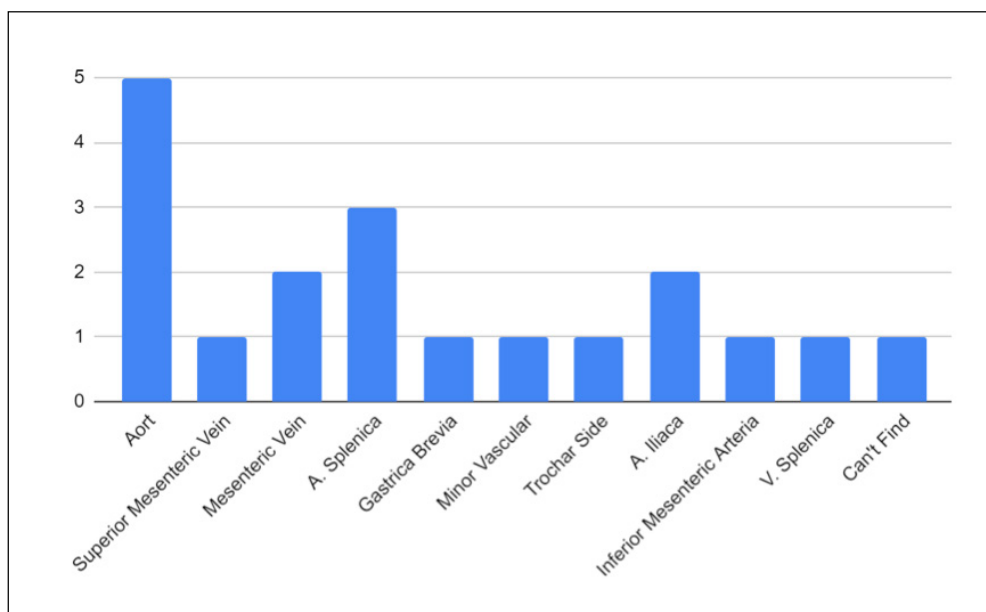


Figure 1. Graphic of injured vascular's names

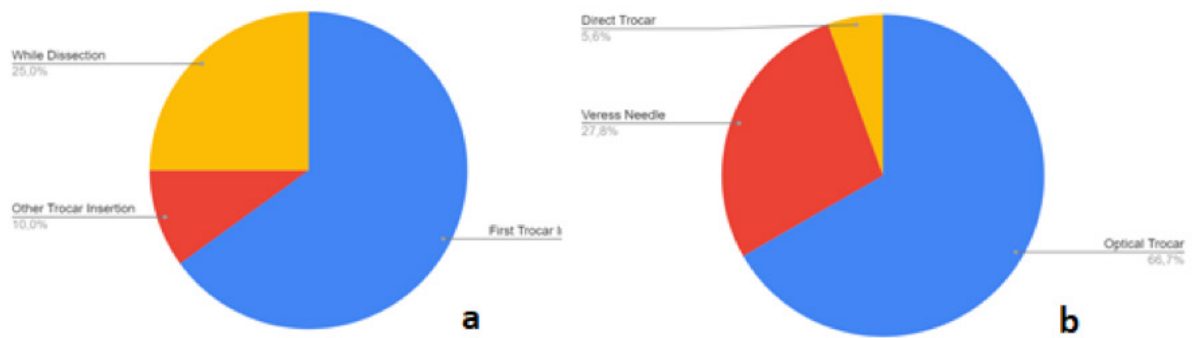


Figure 2. (a) Diagram of the timing of injury (b) Diagram of injury according to entrance.

was 0–10 38.6%, 11–20 22.9%, 21–40 20%, 41–60 10%, 60%, and above 8.4%, respectively. The 16.9% (12 surgeons) of the participants had experienced a major vascular injury during bariatric surgery. Nineteen had an experience of major vascular injury with 5 of them involving the aorta (26.3%), while 57 participants reported no such injuries. Injured vascular structures are illustrated in Figure 1.

75% of the surgeons stated that there was an injury at the trocar entrance, whereas 25% of them were at dissection. 66.7% of them answered that they used optical trocar during these admissions while 27.8% of them used Veress needle and 5.6% directly through trocar (Fig. 2).

45% of the injuries were detected immediately and 30% of them in three minutes (Fig. 3). 52.4% were repaired laparoscopically. Only three surgeons received support from cardiovascular surgeons for the repair and most preferred self-repair. Only two surgeons decided not to continue the operation after noticing the damage. 57.9% of the patients had a hospital stay of 1–3 days, 36.8% had 4–7 days, and mortality was seen in two patients.

DISCUSSION

Laparoscopic bariatric surgery is a widely performed procedure for the treatment of obesity. However, vascular injuries can occur during these surgeries, leading to significant morbidity and mortality. Understanding the incidence, risk factors, and appropriate management of vascular injuries is crucial for improving patient safety and surgical outcomes.

Vascular injuries are rare but potentially serious complications in laparoscopic bariatric surgery. Abdominal access techniques, including the Hasson technique, Veress needle technique, and optical trocar technique, are methods used in laparoscopic surgery to gain entry into the abdominal cavity.

Optical trocar is a type of trocar system that is placed in the abdominal wall and allows the passage of surgical instruments and camera system through trocars during laparoscopic sur-

gery. To discuss the effects of optical trocar usage on vascular injury, the following points can be considered:^[3]

1. **Reduction in Vascular Injury:** The optical trocar system can be placed in a controlled manner to minimize the risk of injury. Its thin and elongated structure can reduce contact with blood vessels and lower the probability of injury.
2. **Decreased Tissue Damage and Bleeding Risk:** The optical trocar system can minimize tissue trauma and reduce the risk of bleeding by applying minimal tension and trauma to soft tissues. This can have a positive impact on the patient's recovery process.
3. **Visual Clarity:** The optical trocar system provides a channel for the passage of the camera system used during laparoscopic surgery. This allows for improved visual clarity, enhancing the surgeon's ability to identify and navigate around vascular structures.

The use of optical trocar in laparoscopic bariatric surgery may contribute to the reduction of vascular injury, minimize tissue damage and bleeding risk, and improve visual clarity for better surgical outcomes. Uncontrolled or improper insertion of the optical trocar can result in vascular trauma,

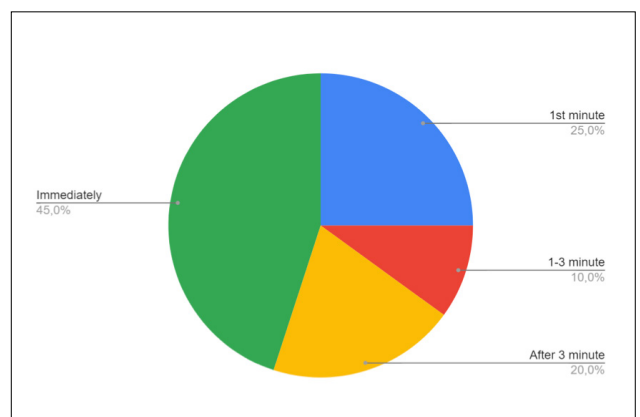


Figure 3. Diagram of detection time of vascular injury.

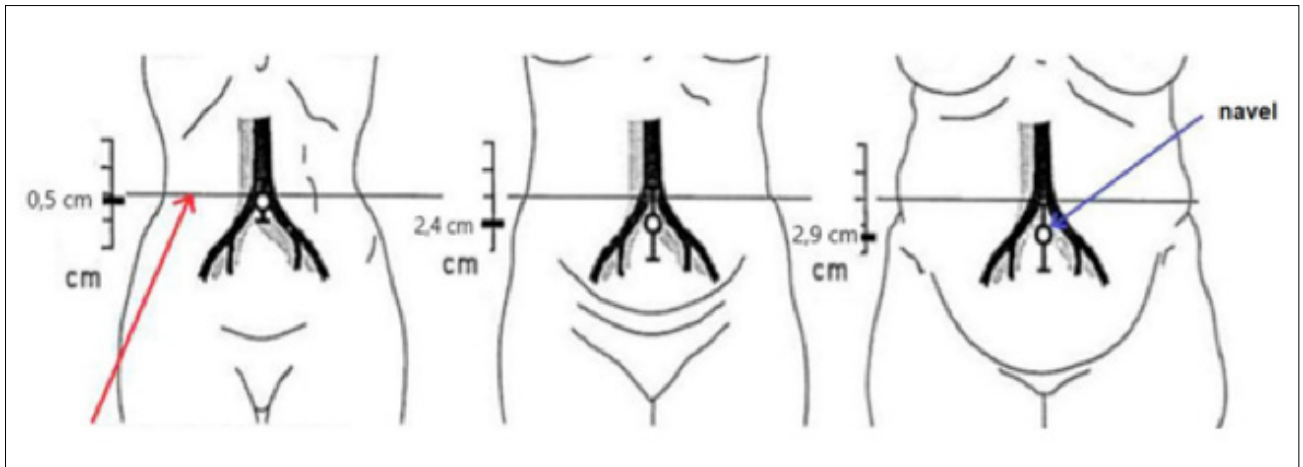


Figure 4. Position of the navel relative to the bifurcation depending on body weight^[9]

including injury to major vessels such as the aorta, mesenteric arteries, or veins. This can lead to severe bleeding and potentially life-threatening complications.

The optical trocar consists of a blunt tip that is inserted into the abdominal cavity to create a working space. If excessive force is applied during insertion or if the optical trocar is placed close to major vessels, it can cause injury to the vascular structures. The risk of vascular injury is particularly high in cases where the patient has significant abdominal adhesions or anatomical variations.^[4] To mitigate the risk of vascular injuries associated with optical trocar use, surgeons should exercise caution and adhere to proper techniques. This includes careful patient selection, meticulous pre-operative assessment, and appropriate positioning of the optical trocar under direct visualization. It is crucial to identify the anatomical landmarks and avoid inserting the optical trocar near major vessels.^[4,5] In cases where there is suspicion of vascular injury during laparoscopic bariatric surgery, prompt recognition and management are essential. Surgeons should be prepared to convert to an open procedure if necessary, and vascular repair or ligation may be required to control bleeding and ensure patient safety. Overall, while the optical trocar can provide several advantages in laparoscopic bariatric surgery, including improved visualization and instrument maneuverability, its use should be approached with caution to minimize the risk of vascular injuries.

Bariatric surgery, a commonly performed procedure for weight loss, can involve certain risks, one of which is vascular injury. Among the various vascular structures at risk during these surgeries, the superior mesenteric vessels are particularly prone to injury. The superior mesenteric artery and vein, responsible for supplying blood to the small intestine, are vulnerable to inadvertent damage during procedures such as gastric bypass or sleeve gastrectomy. This risk arises from the proximity of these vessels to the surgical field and the necessity of manipulating adjacent tissues for proper access and manipulation.^[6,7] Surgeons must exercise utmost caution and

precision to identify and handle the superior mesenteric vessels carefully to avoid potential complications such as intra-operative bleeding or post-operative ischemia. Awareness of this common vascular injury and proper surgical techniques are crucial in minimizing the associated risks and ensuring successful outcomes in bariatric surgery.

The weight of a patient carries substantial implications in this scenario. Hurd et al. conducted a comprehensive study investigating the juxtaposition of the navel in relation to the aortic bifurcation while considering the patient's body structure.^[8] The results elucidated that, on average, the aortic bifurcation maintains a consistent alignment with the 4th lumbar vertebra. However, the navel displays mobility concerning this juncture, which corresponds with an escalation in body weight. In the frontal plane, individuals with a slender build exhibit a mere 0.4 cm separation from the aortic bifurcation. In contrast, this gap significantly widens, averaging 2.4 cm for overweight patients and 2.9 cm for individuals classified as obese. The repositioning of the umbilicus in obese patients, driven by the accumulation of intra-abdominal fat, introduces noteworthy complications during surgical procedures. Specifically, the lower placement of the umbilicus in obese individuals heightens the susceptibility to mesenteric injuries, primarily due to the modified anatomical relationships arising from the surplus adipose tissue within the abdominal region.^[9] These distinct anatomical relationships are elegantly depicted in the accompanying diagram (Pasnik et al., 2019) (Fig. 4).

In bariatric surgery, there is no specific general rule regarding the exact time when the vascular injury is typically detected. The timing of detecting the injury can vary depending on various factors. These factors include surgical techniques, the experience of the surgeon, the anatomical characteristics of the patient, and the size and location of the injury. In some cases, a vascular injury may be immediately recognized during the surgery and can be addressed promptly.^[10,11] However, in other cases, the injury may become evident as symptoms devel-

op after the operation. Therefore, it is crucial for the surgical team to closely monitor the procedure and be vigilant for any signs of possible injury. The surgical team should be attentive to potential signs of injury, such as bleeding, decreased tissue perfusion, or other indicators, during the operation. By doing so, vascular injury can be detected as early as possible, and necessary interventions can be implemented. However, it is important to note that each case may be unique, and the timing of detecting vascular injury can vary from patient to patient and from surgery to surgery.^[11,12] Therefore, careful monitoring and evaluation should be conducted in every bariatric surgery to ensure the early detection and appropriate management of vascular injuries.

Vascular injuries during bariatric surgery can have significant implications for patient outcomes. These injuries can lead to prolonged hospital stays as the severity of the injury, the need for additional surgical interventions, and post-operative complications can contribute to an extended recovery period. Moreover, these injuries can result in substantial intraoperative or post-operative bleeding, necessitating blood transfusions.^[13,14] The extent of bleeding and the severity of the injury determine the amount of blood loss and subsequent transfusion requirements. Higher blood transfusion needs can increase the risk of complications associated with transfusions, such as transfusion reactions or infections, which can impact patient outcomes. In severe cases, vascular injuries may lead to complications that require ICU admission. Close monitoring, aggressive fluid resuscitation, and possible interventions such as embolization or surgical repair may be necessary for patients with significant bleeding, hemodynamic instability, or organ dysfunction.^[15,16] ICU admission adds to the overall health-care burden and can increase the duration of hospitalization. In our study, 57.9% of the patients had a hospital stay of 1–3 days, and 36.8% had 4–7 days. While vascular injuries can be life threatening, the overall mortality rate is relatively low when prompt recognition, timely intervention, and appropriate management are employed. However, if a vascular injury goes unnoticed or is not promptly addressed, severe complications such as hemorrhagic shock, multiple organ dysfunction, or sepsis may arise, increasing the risk of mortality. Hence, it is crucial to promptly recognize these injuries, provide early intervention, and ensure appropriate post-operative care to mitigate potential adverse effects associated with vascular injuries in bariatric surgery.^[16,17] In our study, two patients experienced mortality.

It is important to acknowledge the potential limitations associated with a major vascular injury in bariatric surgery. First, the incidence of major vascular injuries during bariatric procedures is relatively low. This limited occurrence makes it challenging to gather a large sample size for comprehensive studies on the subject. Consequently, the available literature mainly consists of case reports, small case series, and retrospective studies, which may have inherent biases and limitations. Second, the identification of major vascular injuries can

be technically demanding and dependent on the surgeon's experience and intraoperative vigilance. In some cases, these injuries may go undetected during the operation, leading to delayed recognition and management. Third, the impact of major vascular injuries can vary depending on individual patient characteristics, such as comorbidities, anatomical variations, and overall health status. Finally, the available evidence on the specific management strategies and outcomes of major vascular injuries in bariatric surgery is limited. Standardized protocols for their prevention, early detection, and optimal treatment are still evolving, highlighting the need for further research and prospective studies.

CONCLUSION

Vascular injuries are infrequent but potentially serious complications in laparoscopic bariatric surgery. Awareness of the risk factors, early recognition of injuries, and appropriate management strategies are essential for preventing adverse outcomes. In this survey, most of the injuries were due to optical trocars produced reducing the risk of intraabdominal damage. The results of this study may be beneficial for future training courses and conferences, especially in selecting topics related to rare yet essential complications.

Ethics Committee Approval: This study was approved by the Istinye University Ethics Committee (Date: 14.08.2023, Decision No: 2023-6).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: A.S.; Design: T.V.A.; Supervision: O.N.S.; Materials: C.P.; Data collection and/or processing: C.P.; Analysis and/or interpretation: T.V.A.; Literature search: O.N.S.; Writing: T.V.A.; Critical review: A.S.

Conflict of Interest: None declared.

Financial Disclosure: The author declared that this study has received no financial support.

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ORIJİNAL ÇALIŞMA - ÖZ

Rapor edilmemiş nadir fakat ciddi bir komplikasyon: bariatrik cerrahi sırasında major vasküler yaralanmalar

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AMAÇ: Bu çalışmanın amacı, bariatrik cerrahide major vasküler yaralanmaların insidansını, risk faktörlerini, klinik sunumunu ve yönetimini araştırmak; özellikle karın boşluğuna farklı erişim yöntemlerinin rolüne odaklanmaktır.

GEREÇ VE YÖNTEM: Bariatrik cerrahi uzmanlarının katılımıyla ülke genelinde bir anket çalışması gerçekleştirildi ve major vasküler yaralanmaların yaygınlığı değerlendirildi. İki ulusal bariatrik cerrahi derneğinin WhatsApp grupları aracılığıyla 365 cerraha anket gönderildi ve 76 cerrah anketi tamamladı. Çalışma popülasyonu, bariatrik cerrahi uygulayan genel cerrahları içeriyor ve anket 12 sorudan oluşuyordu.

BULGULAR: Katılımcıların %16.9'u bariatrik cerrahi sırasında major vasküler yaralanma yaşadıklarını bildirdi. Yaralanmaların çoğunluğu (%75) trokar girişinde meydana geldi ve geri kalan vakalar diseksiyon aşamasında ortaya çıktı. Önemli bir şekilde, cerrahların %66.7'si erişim için optik trokarlar kullandı, %27.8'i Veress iğne tekniğini uyguladı. Erken tespit oranları farklılık gösterdi; %45'i yaralanmayı hemen fark etti, %30'u ise üç dakika içinde tespit etti. Yaralanmaların çoğu (%52.4) laparoskopik olarak onarıldı ve yalnızca üç cerrah kardiyovasküler cerrahlardan yardım talep etti.

SONUÇ: Major vasküler yaralanmalar, laparoskopik bariatrik cerrahide nadir ancak potansiyel olarak ciddi komplikasyonlardır. İnsidanslarını anlamak, zamanında tanımlama ve uygun yönetim, olumsuz etkileri en aza indirmek için hayati öneme sahiptir. Bu çalışmanın bulguları, vasküler yaralanmaların desenlerini ve özel erişim yöntemlerinin olası rolünü aydınlatarak bariatrik cerrahide hasta güvenliğini artırmak için değerli görüşler sunmaktadır.

Anahtar sözcükler: .Bariatrik cerrahi; major vasküler yaralanma; obezite.

Ulus Travma Acil Cerrahi Derg 2023;29(11):1255-1260 DOI: 10.14744/tjtes.2023.71829