

# MULTILEVEL ENDOSCOPIC THORACIC SPINE SURGERY IN AN OBESE PATIENT: A CASE REPORT

*CIRURGIA ENDOSCÓPICA MULTINÍVEL DA COLUNA TORÁCICA EM PACIENTE OBESO: RELATO DE CASO*

*CIRUGÍA ENDOSCÓPICA MULTINIVEL DE LA COLUMNA TORÁCICA EN UN PACIENTE OBESO: REPORTE DE CASO*

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## ABSTRACT

This article describes an atypical clinical case involving an obese patient with multiple thoracic disc herniations associated with progressive neurological impairment. The patient, a 46-year-old man, presented with severe chest and low back pain radiating to the lower limbs, with a history of treatment failure with conservative approaches and progressive functional deterioration. Magnetic resonance imaging of the thoracic spine revealed three compressive lesions at the T2-T3, T4-T5, and T5-T6 levels, with signs of spinal cord myelopathy. A minimally invasive endoscopic surgical approach was chosen. During the procedure, loss of intraoperative evoked motor potentials was observed, leading to the interruption of the surgery and the scheduling of a second stage to complete decompression. Despite the two-stage surgical intervention, there was no significant clinical recovery. The patient developed severe systemic complications, including nosocomial pneumonia, which culminated in death. Totally endoscopic techniques have established themselves as viable alternatives in high-risk surgical patients, such as those with severe obesity, as they offer lower morbidity and potentially reduce perioperative complications. However, this report highlights that, even with the use of advanced techniques, multifactorial factors can compromise the clinical outcome, highlighting the complexity of neurosurgical management in high-severity cases. **Level of Evidence IV; Case Report.**

**Keywords:** Intervertebral Disc Displacement; Obesity; Endoscopy; Chronic Disease; Spine.

## RESUMO

Este artigo tem como objetivo descrever um caso clínico atípico envolvendo um paciente obeso, portador de múltiplas hérnias discais torácicas associadas a comprometimento neurológico progressivo. O paciente, do sexo masculino, 46 anos, apresentava quadro de dor torácica e lombar intensa, irradiada para os membros inferiores, com histórico de falha terapêutica em abordagens conservadoras e deterioração funcional progressiva. A ressonância magnética da coluna torácica evidenciou três lesões compressivas nos níveis T2-T3, T4-T5 e T5-T6, com sinais de mielopatia medular. Optou-se por abordagem cirúrgica minimamente invasiva por via endoscópica. Durante o procedimento, observou-se perda dos potenciais motores evocados intraoperatórios, o que levou à interrupção da cirurgia e à programação de uma segunda etapa para completar a descompressão. Apesar da intervenção cirúrgica em dois tempos, não houve recuperação clínica significativa. O paciente evoluiu com complicações sistêmicas graves, incluindo pneumonia nosocomial, culminando em óbito. As técnicas totalmente endoscópicas têm se consolidado como alternativas viáveis em pacientes com alto risco cirúrgico, como os portadores de obesidade severa, por oferecerem menor morbidade e potencial redução de complicações perioperatórias. No entanto, este relato evidencia que, mesmo com o uso de técnicas avançadas, fatores multifatoriais podem comprometer o desfecho clínico, ressaltando a complexidade do manejo neurocirúrgico em casos de alta gravidade. **Nível de Evidência IV; Relato de Caso.**

**Descritores:** Deslocamento do Disco Intervertebral; Obesidade; Endoscopia; Doença Crônica; Coluna Vertebral.

## RESUMEN

Este artículo describe un caso clínico atípico de un paciente obeso con múltiples hernias discales torácicas asociadas a deterioro neurológico progresivo. El paciente, un hombre de 46 años, presentó dolor torácico y lumbar intenso irradiado a las extremidades inferiores, con antecedentes de fracaso del tratamiento con estrategias conservadoras y deterioro funcional progresivo. La resonancia magnética de la columna torácica reveló tres lesiones compresivas en los niveles T2-T3, T4-T5 y T5-T6, con signos de mielopatía medular. Se optó por un abordaje quirúrgico endoscópico mínimamente invasivo. Durante el procedimiento, se observó pérdida de los potenciales motores evocados intraoperatorios, lo que obligó a interrumpir la cirugía y programar una segunda etapa para completar la descompresión. A pesar

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de la intervención quirúrgica en dos etapas, no hubo recuperación clínica significativa. El paciente desarrolló complicaciones sistémicas graves, incluyendo neumonía nosocomial, que culminó en su fallecimiento. Las técnicas totalmente endoscópicas se han consolidado como alternativas viables en pacientes quirúrgicos de alto riesgo, como aquellos con obesidad severa, ya que ofrecen menor morbilidad y potencialmente reducen las complicaciones perioperatorias. Sin embargo, este informe destaca que, incluso con el uso de técnicas avanzadas, factores multifactoriales pueden comprometer el resultado clínico, lo que resalta la complejidad del manejo neuroquirúrgico en casos de alta gravedad. **Nivel de Evidencia IV; Informe de Caso.**

**Descriptores:** Desplazamiento del Disco Intervertebral; Obesidad; Endoscopia; Enfermedad Crónica; Columna Vertebral.

## INTRODUCTION

The surgical treatment of calcified disc hernias in the chest spine remains one of the great contemporary challenges of spinal surgery. Regardless of the technique adopted, these cases involve complex patients, often already presenting with severe neurological deficits, significant spinal cord impairment and multiple systemic comorbidities.

In this scenario, endoscopic surgery emerges as a viable therapeutic alternative, with the aim of promoting effective spinal cord decompression with minimal surgical aggression. Despite the scarcity of robust evidence in the literature, reports and series of cases published have contributed to sustain this evolutionary perspective.

The present study describes a clinical case of a patient with morbid obesity and multilevel calcified thoracic disc hernias, treated by uniportal endoscopic technique.

## CASE REPORT

This study was approved by the Research Ethics Committee under protocol 3540420.5.0000.5487.

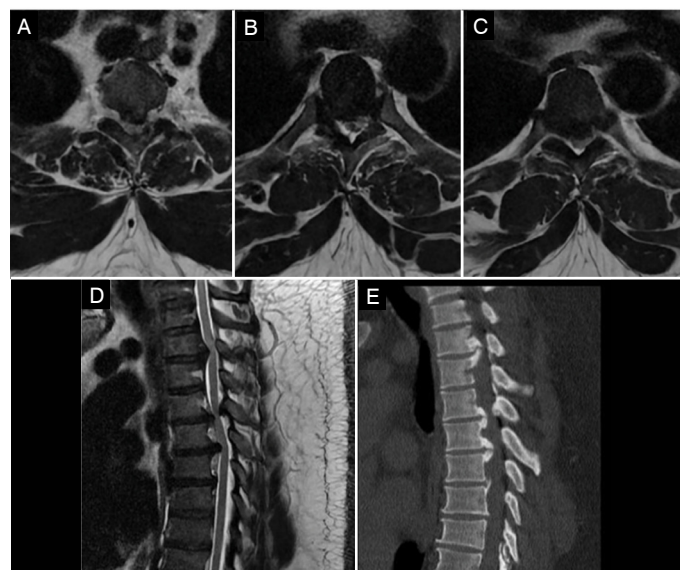
A male patient, 46 years old, entered emergency care with progressive weakness in the lower limbs beginning about six months ago, with marked deterioration in the last four weeks. In the two weeks prior to admission, he evolved into a lack of ability to walk and loss of sphincteric control.

At the physical examination, she showed stable vital signs and body weight of 180 kg, with a history of obesity grade III and systemic arterial hypertension. The neurological evaluation revealed flaccid paraplegia associated with paresthesia in the lower limbs, with sensitivity level determined in T6 and muscle strength grade II in the lower limbs. The pain was classified as 8/10 in the Analog Visual Scale (AVS), located in the middle chest region with irradiation to the lower limbs. Functionality was measured using the *Oswestry Disability Index (ODI)*, indicating severe functional loss, of 68%.

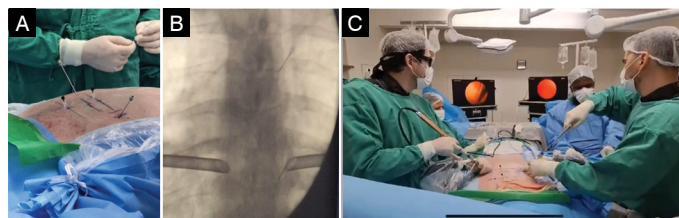
Magnetic resonance imaging and thoracic scan showed extruded and calcified disc hernias at T2-T3, T4-T5 and T5-T6, with significant spinal cord compression (Figure 1).

Given the subacute onset of neurological deficits, surgical treatment consisting of spinal cord decompression and discectomy at the T2-T3, T4-T5, and T5-T6 levels was performed using a uniportal endoscopic technique. Access was carried out by post-lateral extraforaminal bilateral route at all levels, with endoscopic osteotomy of calcifications, in two surgical times. Initially, T4-T5 and T5-T6 levels were addressed bilaterally; four days later, in the second time, the T2-T3 level was decompressed bilaterally. The decision for the two-time approach was motivated by the estimated long duration of the procedure involving multiple forums and the presence of clinical comorbidities (hypertension and decompensated glycemic levels) of the patient.

The surgeries were performed under general anesthesia and intraoperative neurophysiological monitoring (IONM). The IONM demonstrated somatosensory potential and low amplitude motor, indicating significant functional impairment of the spinal cord. The surgical levels were identified by fluoroscopy in anteroposterior and lateral projections, with marking of some pedicles with spinal needles (Figure 2A). The entry points were located nine centimeters from the middle line, with fluoroscopic confirmation. The dilator and the working canula were introduced sequentially to the side edge of the facet joint at each level, simultaneously, using two video towers and two sets of instruments (Figure 2B and 2C).



**Figure 1.** Axial cuts of the chest spine magnetic resonance (A, B and C) and sagittal cuts of the magnetic resonance (D) and computed tomography (E), evidencing calcified extruded disc hernias T2-T3 (A), T4-T5 (B) and T5-T6 (C).



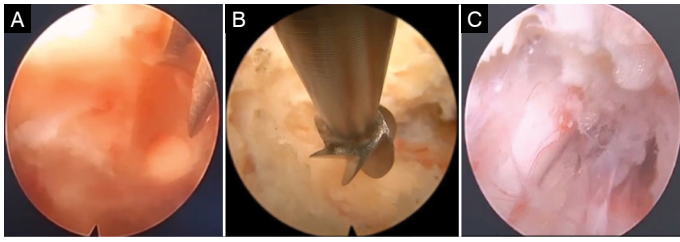
**Figure 2.** Confirmation of the surgical level with the help of spinal needles positioned on the pedicles, guided by fluoroscopy in anteroposterior incidence (A). Positioning of work shirts for simultaneous bilateral access (B). Disposition of surgeons for simultaneous post-lateral extraforaminal chest access (C).

Foraminoplasty was performed with high rotation drill, including resection of the inferior articular process (IAP) of the cranial vertebra and the superior articular process (SAP) of the caudal vertebra. Due to the coronalization of facet joints in the upper chest spine, bone resection was initiated by IAP, followed by SAP.

Endoscope transforaminal ENDOLINE (MORE, Ribeirão Preto, Brazil) was used with 4.3mm working channel and 30 degrees of angle. The irrigation system was by gravity technique, with the physiological serums positioned 1.5m above the height of the patient.

After intraoperative identification of disc calcifications within the interbody space, endoscopic osteotomies were performed using osteotome and a cutting drill (Figure 3A and 3B). The resection involved the posterior portion of the adjacent vertebral bodies (cranial and caudal), with controlled progression under direct endoscopic vision and anteroposterior fluoroscopic orientation until it exceeded the median line bilaterally, with the aim of decompressing the neural structures and optimizing the disk space (Figure 3C).

The procedure was conducted in two surgical times. The first



**Figure 3.** Osteotomy of calcified hernia, using osteotome (A) and cutting drill (B). Final aspect of the decompression with direct visualization of the completely released spinal cord (C).

time lasted 180 minutes and the second 150 minutes. At the end of the first half, there was a discrete deterioration in the potential motors at IONM, which remained unchanged after the end of the second half.

In the immediate postoperative period, the patient was observed in the intensive care unit (ICU), showing initial hemodynamic stability. However, it evolved with an episode of pulmonary aspiration, followed by respiratory infectious frame by multidrug-resistant bacteria, culminating in hospital pneumonia. Despite the intensive therapeutic measures adopted, the patient evolved to death after four weeks of hospitalization.

## DISCUSSION

Thoracic disc hernias account for approximately 0.1% to 3% of all intervertebral hernias, the symptomatic forms being responsible for less than 1% of cases, in contrast with the highest prevalence observed in the lumbar and cervical regions.<sup>1</sup> The most common location is at the level of T7-T8, which accounts for approximately 75% of cases.<sup>2</sup> The T11-T12 disc, in turn, is more prone to degeneration due to its relative mobility and the fragility of the posterior longitudinal ligament in this segment.

Most thoracic hernias occur in central or posterolateral position, with less than 10% presenting lateral location.<sup>3</sup> Discal calcification is observed in 30% to 70% of cases, and about 5% to 10% of hernias are associated with intradural extension.<sup>4</sup> In addition, these hernias may integrate tandem stenosis frames, often associated with lumbar stenosis, although they may also coexist with cervical stenosis.<sup>5</sup>

The clinical presentation is variable and depends on the level affected, and may include local, axial or radicular pain, signs of myelopathy, hyperreflexia, spasticity, as well as autonomous dysfunctions such as vesical or intestinal changes. The most common initial symptoms are paresthesia in the lower limbs, muscle weakness and changes in walking.<sup>6</sup>

Thoracic myelopathy associated with disc hernias tends to be of a progressive nature. The presence of progressive myelopathy associated with spinal cord compression is an absolute indication for surgical intervention. Cases of stable myelopathy, without significant functional deficits, or refractory root pain to conservative treatment, configure relative indications, and should be evaluated individually. On the other hand, in the absence of clinical signs of myelopathy, conservative treatment is generally considered appropriate, with periodic clinical and radiological monitoring. It is important to note that neurological symptoms can mimic compressions in other segments of the spine, such as the cervical or lumbar, which can result in delayed diagnosis or incorrect location of the injury, making therapeutic planning difficult.<sup>7</sup>

With the advancement of imaging techniques, there was a significant increase in the detection of thoracic stenosis, often previously underdiagnosed. The most recommended examinations include magnetic resonance imaging, which allows detailed evaluation of the spinal cord and neural structures, and computed tomography, useful to identify disc calcifications and bone changes. Simple X-rays are also recommended to exclude relevant anatomical variations before any surgical approach.

In the case of surgical indication, the minimally invasive techniques

for the treatment of disc hernias have evolved significantly, with the emergence of different possibilities of surgical approaches.

Spinal endoscopy, in turn, has consolidated itself as a widely accepted technique, driven by the technological advances of the last two decades. This approach has been preferred by both surgeons and patients for offering significant advantages compared to conventional open surgery, including immediate pain relief, faster recovery and less anesthetic requirement.<sup>8</sup>

Among the additional benefits compared to open and microendoscopic techniques, we highlight the reduced cutaneous incision (6-7 mm), the broadened visual field, improved illumination, minimal tissue dissection, continuous irrigation with less bleeding, preservation of paravertebral muscles and low rate of complications.<sup>9</sup> These factors contribute significantly to the reduction of surgical time, acceleration of postoperative recovery and shorter hospitalization time.

The endoscopic discectomy in the chest spine remains little documented, due to the low prevalence of this condition and the technical complexity involved.<sup>10</sup> However, when well indicated, surgical intervention can preserve neurological function and prevent the progression of clinical symptoms, contributing to better quality of life of the patient.<sup>11</sup>

However, surgical results in thoracic disc hernias tend to be less favorable when compared to those of cervical hernias, reflecting the greater local anatomical complexity and the high risk of neurological complications. Studies involving discectomy in voluminous chest hernia show that about 53% of patients show neurological improvement, 42% remain stable and 5% develop with clinical deterioration. The volume of the hernia and the presence of calcifications are among the main predictors of unfavorable clinical outcome.<sup>12</sup>

The choice of the ideal surgical approach to the treatment of thoracic disc hernia should consider multiple factors, including the size and location of the hernia in the vertebral canal, the anatomical level affected, the presence of calcifications, the degree of spinal cord compression and the surgeon's experience with different access techniques.

Comparative studies indicate similar rates of perioperative events between the lateral (39%) and posterior (36%) traditional open pathways. However, the lateral approach is associated with the greater number of intra-hospital and post-discharge complications, which should be considered in the selection of the surgical technique.<sup>13</sup>

There is consensus in the literature on the effectiveness of post-lateral open approaches for soft disc hernias localized in central or post-lateral form. However, the ideal approach for central calcified hernias or giant hernias (defined as those that occupy more than 40% of the diameter of the vertebral canal) in which the anterior pathway, such as thoracotomy or thoracoscopy, is traditionally performed remains controversial.

Despite this, recent evidence has shown promising results with post-lateral endoscopic approaches even in complex cases, including central and voluminous calcified hernias. These techniques, when well indicated and performed by experienced surgeons, can offer less morbidity, preservation of neurological function and faster recovery, expanding the therapeutic possibilities in the management of chest hernia.<sup>14</sup>

In any case, the surgical treatment of thoracic disc hernias represents a significant challenge, due to the anatomical limitations of the region and the high risk of morbidity associated with the proximity of the thoracic spinal cord. The surgical approach requires precision and caution, and IONM is an indispensable tool for the safety of the procedure. This monitoring is carried out through the combination of motor evoked potential (MEP) and somatosensory potential (SSEP), allowing the early detection of functional alterations during neural manipulation.

Calcified disc hernias are associated with a higher incidence of changes in neuromonitoring signs, which may indicate an increased risk of spinal cord injury. The correct identification of the surgical level is essential, especially in the face of anatomical variations such as the atypical number of lumbar vertebrae or accessory ribs, which may make it difficult to locate the lesion accurately.<sup>15</sup>

Detailed knowledge of segmental anatomy and its variants is therefore essential for surgical planning and for reducing intraoperative risks.

Another fundamental factor to consider is obesity, which corresponds to a growing health problem in both developed and developing countries, becoming, along with cardiometabolic diseases, one of the main public health problems worldwide.

By 2022, approximately 16% of adults aged 18 or older worldwide were obese. Global prevalence of obesity increased more than 100% between 1990 and 2022.<sup>16</sup>

Obesity is highly prevalent among patients undergoing elective spine surgery for the treatment of degenerative diseases, and is associated with increased incidence of perioperative complications. This correlation reinforces the importance of careful preoperative evaluation and appropriate selection of candidates for surgical intervention.<sup>17</sup>

Obese individuals constitute a unique clinical population, with differentiated response to surgical and conservative treatment, in addition to presenting significantly higher rates of postoperative complications. With the continuous growth of the prevalence of obesity in the general population, it is expected that these patients represent a substantial share of the neurosurgery practice.

Obesity, defined as body mass index (BMI)  $\geq 30$  kg/m<sup>2</sup>, is a systemic, chronic and multifactorial condition, with global distribution that transcends economic boundaries, ethnicities, age groups and social classes. Recognized by the World Health Organization as the "epidemic of the 21st century," its growing prevalence has significant implications for public health.<sup>18</sup>

It is associated with several comorbidities, including type 2 diabetes mellitus, systemic arterial hypertension, osteoarthritis, obstructive sleep apnea, and depressive disorders. Although the systemic impacts are well established, recent evidence indicates that obesity also plays a significant role in accelerated disc degeneration, spinal arthritis, and chronic lumbar pain.<sup>19</sup>

With the continuous increase in the prevalence of obesity in the general population, spinal surgeons are expected to face a growing demand for surgical procedures in obese patients, requiring technical adaptations and specific strategies for safe and effective perioperative management.

The chronic inflammatory process associated with obesity has been implicated in the physiopathology of discal degeneration. Adipocytes, in addition to acting as energy reservoirs, exercise endocrine function by secreting pro-inflammatory cytokines, called adipokines, being the leptin the most studied. High levels of these substances are associated with the progression of osteoarthritis in various joints and, in the spine, contribute to aberrant cell aggregation and degradation of the extracellular matrix of discal tissue.<sup>20</sup>

In addition to inflammatory factors, there is evidence that genetic-environmental interactions also play a relevant role in disc degeneration in obese individuals. A punctual mutation in the COL9A3 gene involving arginine replacement with tryptophan has been independently associated with discal degeneration and the occurrence of sciatica.<sup>21</sup>

In addition, elevated levels of Apolipoprotein E (ApoE) have been associated with chronic low back pain, suggesting a possible underlying inflammatory and vascular mechanism. Obesity, in turn, is correlated to the increase in ApoE and peripheral vascular disease, contributing to discal ischemia and, consequently, to a higher incidence of degenerative pathologies of the spine.<sup>22</sup>

Several studies have shown that obese patients undergoing spine surgery have longer surgical time, increased intraoperative blood loss, higher hospital costs, increased risk of mortality and higher incidence of pulmonary thromboembolism.<sup>23</sup> Furthermore, these patients often have multiple comorbidities, such as diabetes mellitus and coronary artery disease, which are independent risk factors for postoperative complications.<sup>24</sup>

Obesity is also strongly associated with high rates of postoperative infection.<sup>25</sup> A characteristic set of complications can occur, including: surgical site infection, liquor fistula, deep venous thrombosis, cardiovascular events, symptomatic pseudoarthrosis, pneumonia,

need for prolonged intubation, urological complications, paresis or paralysis due to inadequate positioning and neuropathic pain.<sup>17</sup>

Recent evidence suggests that the distribution of adipose tissue may play a significant role in the development of infections of the surgical site after procedures in the spine. Studies have shown association between infection and parameters such as skin-to-skin distance and subcutaneous tissue thickness measured by MRI.<sup>26</sup> These findings introduce the hypothesis that body habit, and not just body mass index (BMI), may be a more accurate predictor of infectious risk, especially in individuals with elevated muscle mass and elevated BMI, but with a lower proportion of fat tissue.

Another complication feared in the context of obesity is venous thromboembolism. Obesity is recognized as an independent risk factor for deep vein thrombosis and pulmonary embolism, attributed to chronic inflammatory state, fibrinolysis dysfunction, increased thrombin generation and platelet hyperactivity.<sup>27</sup>

Although the current literature highlights the increased risk of postoperative infections and venous thromboembolic events, it also points to the potential benefit of surgical intervention in obese patients, especially in view of the unsatisfactory results observed with non-surgical treatment.<sup>24</sup>

Although the literature presents conflicting data regarding surgical outcomes in obese patients, this interpretation should be done with caution. Obesity is consistently associated with worse basal functional state and worse results with conservative treatment, which can negatively influence comparisons between different therapeutic approaches.<sup>28</sup> In the context of spine surgery, there is a growing trend in the adoption of minimally invasive techniques, due to less tissue aggression and the potential for better postoperative recovery. Asano et al. (2019)<sup>29</sup> demonstrated that obese patients with lumbar disc hernia undergoing minimally invasive endoscopic discectomy presented clinical outcomes similar to those of non-obese patients.

Multi-level thoracic disc hernias are significantly more rare than isolated lesions, and their diagnosis and management represent relevant clinical challenges. The isolated neurological findings often fail to accurately identify the level responsible for the symptoms, given the clinical overlap between the affected segments. Patients with multiple chest hernia may experience pain, radiculopathy or myelopathy similar to those with single lesion, which in most cases justifies the need for surgical approach at all levels involved.<sup>30</sup>

In patients with progressive neurological deterioration, surgery represents the main and, in many cases, the only therapeutic option with potential to improve symptoms. However, despite its decisive nature, the results and postoperative prognosis are influenced by multiple factors.

In the present clinical case, factors such as severe neurological impairment at admission, prolonged time of symptom progression, multi-level calcified disc impairment and the presence of relevant systemic comorbidities (grade III obesity, decompensated hypertension, immobilization) negatively influenced the clinical outcome. These variables reinforce the importance of a comprehensive preoperative evaluation, with emphasis on risk stratification, and an individualized surgical planning, especially in patients with complex clinical profile. Early identification of adverse prognostic factors can guide the selection of the most appropriate technique and enable the adoption of intraoperative and postoperative strategies that minimize complications and optimize functional results.

## CONCLUSION

The postoperative outcomes in thoracic disc hernias are influenced by multiple factors, including the surgical approach used, the etiology of the injury, the duration of the symptoms and the presence of concomitant stenosis. In this context, although endoscopic techniques represent a promising minimally invasive alternative, obese patients with multilevel pathology present a greater risk of complications, requiring individualized surgical planning and strict monitoring in the perioperative period. Additional studies are needed to clarify the most appropriate therapeutic strategies for different patient profiles within this specific population.

**CONFLICT OF INTEREST**

All authors declare no potential conflict of interest related to this article.

**CONTRIBUTIONS OF THE AUTHORS**

Each author contributed individually and significantly to the development of this article. LRN, AMMB, RRA: conceptualization, writing - original draft; KFFM, ECQAB, MPD: data curation, validation; SEL, JPMB: formal analysis, writing - review and editing.

**DATA AVAILABILITY DECLARATION**

The contents underlying the research are available in the manuscript.

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