



## **Impact of minimally invasive surgery on elderly patients**

*Repercusión de la cirugía mínimamente invasiva en el paciente anciano*

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### **ABSTRACT**

Population aging presents new challenges to surgical services, where elderly patients represent a vulnerable group with a high frequency of comorbidities, frailty, and diminished functional reserve. Minimally invasive surgery has emerged as an alternative capable of modifying the traditional paradigm of surgical risk in this age group. This article analyzes the impact of these techniques on functional recovery, postoperative morbidity, and the autonomy of older adults, as well as the challenges in their implementation. It argues that, beyond the technical benefit, the true impact lies in the adoption of a comprehensive approach that combines minimally invasive access with

multimodal rehabilitation strategies, individualized perioperative management, and shared decision-making. Evidence supports its use in selected populations, but barriers related to the learning curve, resource availability, and the need for validated frailty scales persist. It is concluded that minimally invasive surgery is a valuable tool for improving outcomes in older adults, provided it is applied within a person-centered care model and with sound clinical judgment.

**Keywords:** Minimally Invasive Surgery, Elderly Patient, Frailty, Enhanced Recovery After Surgery, ERAS

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## RESUMEN

El envejecimiento poblacional impone nuevos retos a los servicios quirúrgicos, donde el paciente anciano representa un grupo vulnerable con alta frecuencia de comorbilidades, fragilidad y reserva funcional disminuida. La cirugía mínimamente invasiva ha emergido como una alternativa capaz de modificar el paradigma tradicional del riesgo quirúrgico en este grupo etario. En el presente artículo se analiza la repercusión de estas técnicas sobre la recuperación funcional, la morbilidad postoperatoria y la autonomía del adulto mayor, así como los desafíos en su implementación. Se argumenta que, más allá del beneficio técnico, el verdadero impacto radica en la adopción de un enfoque integral que combine el acceso mínimamente invasivo con estrategias de rehabilitación multimodal, individualización del manejo perioperatorio y toma de decisiones compartidas. La evidencia respalda su uso en poblaciones seleccionadas, pero persisten barreras relacionadas con la curva de aprendizaje, la disponibilidad de recursos y la necesidad de escalas de fragilidad validadas. Se concluye que la cirugía mínimamente invasiva constituye una herramienta valiosa para mejorar los desenlaces en el anciano, siempre que se aplique dentro de un modelo de atención centrado en la persona y con un juicio clínico ponderado.

**Palabras clave:** Cirugía Mínimamente Invasiva, Paciente Anciano, Fragilidad, Recuperación Mejorada Después De Cirugía, ERAS

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Population aging is one of the most significant health phenomena worldwide. In Cuba, the aging process has accelerated considerably, reaching 25.7% of the population aged 60 and over in 2024, placing the country among the most aged in Latin America and the Caribbean <sup>(1)</sup>. This phenomenon, resulting from the demographic transition with persistently low fertility rates and increased

life expectancy, translates into a greater demand for surgical procedures in advanced age groups <sup>(2)</sup>.

Traditionally, elderly patients have been considered high-risk for surgery due to the presence of multiple pathologies, polypharmacy, sarcopenia, and accumulated physiological decline <sup>(3)</sup>. However, in recent decades, the development of minimally invasive surgery (MIS) has changed this landscape by offering potential benefits in terms of less surgical trauma, reduced postoperative pain, faster functional recovery, and shorter hospital stays <sup>(4)</sup>. However, extrapolating these benefits to elderly patients requires critical analysis that considers not only technical aspects but also underlying frailty, patient preferences, and the organization of healthcare systems <sup>(5)</sup>.

This article aims to analyze the impact of minimally invasive surgery on elderly patients from a comprehensive perspective, highlighting its benefits, limitations, and the determining factors for its rational and safe use in this age group.

The adoption of minimally invasive surgery in general surgery has been one of the most significant innovations of recent decades. Procedures such as laparoscopic cholecystectomy, hernioplasty, colorectal resection, and gastrectomy, among others, are now routinely performed using minimally invasive approaches <sup>(6)</sup>. In elderly patients, the theoretical benefits of minimally invasive surgery (MIS) take on particular relevance, as the reduction of the systemic inflammatory response, less postoperative pain, and early mobilization can contribute to preserving functionality and avoiding classic complications such as delirium, pneumonia, or prolonged immobilization <sup>(7)</sup>.

Multiple observational studies and recent meta-analyses have demonstrated that, in selected patients, laparoscopic surgery is associated with lower overall morbidity, shorter hospital stays, and readmission rates similar to or even lower than those of open surgery. A 2022 meta-analysis that included 24 studies in elderly patients with colorectal cancer demonstrated that laparoscopic surgery was associated with a lower risk of postoperative mortality (RR 0.70; 95% CI: 0.53–0.94), less blood loss (mean difference - 78.85 ml), shorter hospital stay (-2.53 days), and a lower risk of complications (RR 0.66; 95% CI: 0.60–0.74) compared to open surgery <sup>(8)</sup>.

However, these findings require qualification. Most studies exclude patients with severe frailty, advanced dementia, or significant functional dependence, which limits the external validity of their conclusions <sup>(9)</sup>. In daily clinical

practice, the decision to offer a minimally invasive approach should be based on a multidimensional assessment that goes beyond chronological age. Frailty, assessed using scales such as the Edmonton Frailty Scale (EFS) or the Clinical Frailty Scale (CFS), has been shown to be a more reliable predictor of adverse outcomes than age alone <sup>(10)</sup>.

The American College of Surgeons (ACS), in collaboration with the American Geriatrics Society, has issued clinical practice guidelines recommending the systematic incorporation of frailty assessment into the preoperative consultation <sup>(11)</sup>. Recent studies have demonstrated that frailty assessment is capable of predicting postoperative complications in elderly patients undergoing elective major abdominal surgery, with scores  $\geq 4$  points associated with a higher risk of postoperative morbidity as measured by the Comprehensive Complication Index <sup>(12)</sup>.

On the other hand, the incorporation of frailty assessment in the elderly presents clinical and organizational challenges. First, the learning curve associated with these techniques means that the results depend largely on the surgeon's experience and the volume of procedures performed at the center <sup>(13)</sup>. In populations with a high prevalence of comorbidities and anatomical variations, such as older adults, an inadequate learning curve can result in longer surgical times, intraoperative complications, and significant conversion rates <sup>(14)</sup>.

Second, access to minimally invasive surgery (MIS) is not always equitable. In resource-limited settings, the availability of equipment, the training of personnel, and adequate infrastructure affect the uniform implementation of these techniques. This can lead to inequalities in surgical care for the elderly, where the benefits of MIS are restricted to certain centers or patients <sup>(15)</sup>.

Third, while less invasive, MIS does not replace the need for rigorous perioperative optimization. Enhanced Recovery After Surgery (ERAS) programs for elderly patients have demonstrated synergy with minimally invasive approaches by promoting early mobilization, opioid-free pain management, and early initiation of nutrition <sup>(16)</sup>. A recent 2024 meta-analysis evaluating multimodal prehabilitation within ERAS programs in elderly patients undergoing elective colorectal surgery demonstrated significant improvements in functional capacity as measured by the 6-minute walk test (mean difference 18.38 meters; 95% CI: 1.51–35.25;  $p = 0.04$ ), although no significant differences were found in hospital stay or postoperative complications <sup>(17)</sup>.

When these elements are systematically integrated, outcomes improve substantially, even in patients with established frailty <sup>(18)</sup>. The ACS NSQIP has developed a surgical risk calculator that incorporates specific geriatric variables (housing status, history of falls, use of mobility aids, cognitive impairment) that allows for the prediction of relevant postoperative outcomes for older adults, such as delirium, pressure ulcers, new use of mobility aids, and functional decline <sup>(19)</sup>.

In the Cuban context, laparoscopic surgery has developed progressively in recent years, with favorable experiences in several institutions across the country. However, gaps still remain in the standardization of specific protocols for elderly patients, the incorporation of frailty assessment as a systematic preoperative criterion, and the availability of multimodal rehabilitation programs <sup>(20)</sup>.

The training of general surgery specialists must include solid competencies in minimally invasive surgery (MIS) and in the management of geriatric surgical patients, addressing not only surgical technique but also shared decision-making with the patient and their family, considering their values and functional expectations. Likewise, it is essential to promote national research that evaluates medium- and long-term functional outcomes, beyond immediate complications, to refine indications and improve candidate selection.

Minimally invasive surgery represents a valuable tool in the surgical management of elderly patients, offering potential benefits in terms of reduced morbidity, faster functional recovery, and preservation of autonomy. However, its application must be carried out under a comprehensive approach that combines appropriate patient selection based on frailty, the use of multimodal rehabilitation programs, and the guarantee of sufficient human and technological resources.

Chronological age should not be an exclusionary criterion in itself, but neither should it be a factor that leads to underestimating the complexity of the elderly patient. The current challenge lies not only in demonstrating the superiority of minimally invasive surgery (MIS), but also in ensuring that its implementation is equitable, safe, and focused on the specific needs of older adults. From the perspective of Cuban general surgery, it is imperative to move toward care models that integrate technical innovation with excellence in geriatric care, with the goal of offering safer, more humane, and more effective surgery for our elderly.

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### **CONFLICT OF INTEREST**

The authors declare no conflict of interest.

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