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# MINIMALLY INVASIVE SURGERY IN UZBEKISTAN: A COMPREHENSIVE REVIEW

***Dr Khadka Ravi Roshan,*** *MBBS, MS*
*Associate Professor*
*dr.ravi7209@gmail.com*
*Faculty of International Students, Asia International University*

## Abstract

Background: Surgical care is essential to modern healthcare, impacting morbidity, mortality, and quality of life. Over the past decade, Uzbekistan has advanced its surgical services, integrating minimally invasive, robotic-assisted, pediatric, cardiovascular, orthopedic, and oncologic procedures. Methods: A structured review of PubMed, Scopus, regional databases, and institutional reports from 2014–2026 was conducted. Studies reporting innovative surgical techniques, robotic and minimally invasive interventions, and complex pediatric or oncologic procedures in Uzbekistan were included. Results: Minimally invasive surgery, including laparoscopic cholecystectomy, appendectomy, liver echinococcosis management, and ERCP-assisted procedures, is widely adopted, reducing postoperative pain, hospital stay, and recovery time. Robotic-assisted surgery, including radical prostatectomy, partial nephrectomy, and complex oncologic procedures, offers enhanced precision, ergonomics, and shorter learning curves. Pediatric surgeries, cardiovascular interventions, orthopedic and onco-orthopedic procedures, and laparoscopic oncologic resections demonstrate improved clinical outcomes. International conferences, workshops, and live surgery demonstrations support skill transfer and research dissemination. Conclusion: Uzbekistan has rapidly adopted advanced surgical techniques with measurable patient benefits. Continued investment in training, infrastructure, and international collaboration is essential to sustain progress and achieve global surgical standards.

Keywords: Minimally invasive surgery, robotic-assisted surgery, pediatric surgery, oncologic surgery, Uzbekistan.

## Introduction

Surgical care is a cornerstone of modern healthcare, influencing morbidity, mortality, and quality of life worldwide. Over the last decade, Uzbekistan has undertaken a strategic transformation of its surgical services, incorporating minimally invasive, robotic-assisted, and endovascular approaches.[1] These innovations, coupled with professional training and international collaboration, have expanded the country's capacity to manage complex surgical cases domestically, reducing dependence on foreign medical care.[2]

This review focuses on the current surgical landscape in Uzbekistan, describing technological adoption, clinical outcomes, and scientific collaborations, while emphasizing procedures that demonstrate measurable improvement in patient recovery, morbidity, and long-term prognosis.

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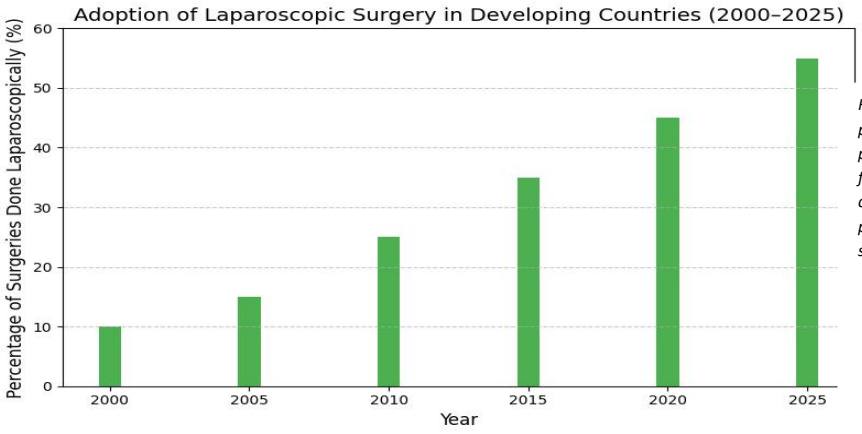


*Fig: These figures reflect published trends and expert projections in surgical literature for low- and middle-income countries where laparoscopy has progressively expanded across surgical specialties.*

**Minimally Invasive Surgery**

Minimally invasive surgery (MIS) has become widely adopted in Uzbekistan's tertiary centers, driven by evidence demonstrating reduced postoperative pain, shorter hospital stays, and faster recovery.

Laparoscopic cholecystectomy has become the standard for gallbladder disease, performed in over 70% of cases. Single-incision laparoscopic appendectomy is widely used in acute appendicitis, particularly in pediatric populations, minimizing surgical trauma. Laparoscopic management of liver echinococcosis involves cyst aspiration, deroofing and omentoplasty, reflecting endemic disease burden management. Endoscopic retrograde cholangiopancreatography (ERCP) combined with laparoscopic cholecystectomy is increasingly performed for choledocholithiasis. [2-3]


Singleincision laparoscopic port. (A) The port is composed of one 5mm and two 12mm trocar channels. (B) The umbilical wound of singleincision laparoscopic appendectomy at immediate postoperative time.

Minimally invasive surgery (MIS), including laparoscopy and endoscopic techniques, offers significant clinical advantages compared to conventional open surgery. It is associated with reduced postoperative pain, smaller incisions, lower risk of surgical site infections, shorter hospital stay, faster recovery, and improved cosmetic outcomes.[12,13] MIS also results in decreased blood loss, earlier return to normal activities, and reduced overall healthcare costs due to shorter hospitalization.[14] Additionally, enhanced visualization through magnification improves

surgical precision in selected procedures.[15] Despite technical demands, MIS has become the standard of care for many abdominal and thoracic operations due to these benefits.[12,14]

**Robotic-Assisted Surgery**

Robotic-assisted surgery has been introduced in specialized Uzbek centers, enhancing precision and ergonomics in complex procedures.

Robotic-assisted radical prostatectomy and partial nephrectomy have been successfully performed with the REVO-I and da Vinci platforms. Low anterior resection and total mesorectal excision for rectal cancer utilize robotic systems to navigate narrow pelvic anatomy, improving visualization and preserving function. Complex hernia repairs and gynecologic oncologic surgeries are increasingly performed robotically, reducing operative blood loss and postoperative complications.[4-6]


*Fig; Robotic-assisted surgery*

Robotic-assisted surgery offers several advantages over conventional laparoscopy, including enhanced precision through high-definition 3D visualization and articulating instruments, improved ergonomics reducing surgeon fatigue, and the ability to perform complex procedures such as radical prostatectomy or hepatobiliary resections with greater ease. It also shortens the learning curve for technically demanding minimally invasive surgeries and may reduce intraoperative blood loss and conversion to open procedures. However, robotic surgery remains limited by higher costs, longer setup times, and restricted availability in developing countries, while perioperative outcomes are generally comparable to laparoscopic approaches

**Pediatric and Complex Surgery**

Uzbekistan has expanded pediatric surgical services, including:

Pediatric liver transplantation for metabolic and end-stage liver disease. Laparoscopic pyeloplasty and minimally invasive repair of congenital diaphragmatic hernia. Endoscopic treatment of vesicoureteral reflux using dextranomer/hyaluronic acid injections.[7]

**Cardiovascular and Endovascular Innovations**

Transcatheter closure of atrial and ventricular septal defects (ASD, VSD). Balloon angioplasty and stenting for congenital and acquired vascular lesions. Non-fluoroscopic percutaneous interventions, reducing radiation exposure, particularly for children.[8]

### Orthopedic and Onco-Orthopedic Surgery

Expandable endoprostheses for pediatric osteosarcoma. Increasing use of arthroscopic joint surgery (knee, shoulder) for traumatic and degenerative conditions with improved functional recovery.[2,9]

### Oncologic Surgery

Laparoscopic colorectal cancer resections.· Laparoscopic gastrectomy for gastroesophageal cancers · Minimally invasive thyroidectomy and parathyroidectomy. Endoscopic/transurethral resection of bladder tumors [10,17,18] · Multidisciplinary tumor boards coordinate surgical, medical, and radiotherapy interventions.

### Scientific Collaboration and Training

Uzbekistan hosts international conferences, workshops, and live surgery demonstrations, facilitating skill transfer. The journal "Surgery of Uzbekistan" disseminates regional innovations to a broader audience, promoting research-based surgical practice.[11]

### Discussion

Uzbekistan demonstrates rapid adoption of modern surgical techniques with measurable improvements in patient outcomes. Challenges include limited national surgical databases, need for formal robotic and MIS training programs, and ensuring equitable access. Continued investment in research, infrastructure, and international collaboration will further solidify Uzbekistan's position in advanced surgical care.

### Conclusion

The last decade has seen transformative changes in Uzbekistan's surgical landscape, including minimally invasive, robotic-assisted, pediatric, cardiovascular, orthopedic, and oncologic surgery. Evidence-based adoption of advanced techniques, coupled with professional training and scientific collaboration, positions the country to meet global surgical standards. Sustained efforts in research, policy, and technology integration are essential to maximize clinical outcomes and regional leadership.[1–11]

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