Dr. A.T. Gowribahan: A Profile

Dr. A.T. Gowribahan, a native of Jaffna, demonstrated exceptional promise from his early years at St. John's College, where his outstanding academic and extracurricular excellence was evident. A natural leader, he served as School Captain and captained the First XI team in four major sports - cricket, football, basketball, and volleyball - earning five School Colours for his athletic prowess. Academically, he consistently excelled, winning the General Excellence Award at the Advanced Level Examinations and serving as a Senior Prefect.

He entered the Medical Faculty with a District Rank of 15 and continued to balance his pursuits with distinction at the University of Jaffna, representing the university in cricket and basketball while earning a Second Class in his medical examinations.

He began his career as an Intern Medical Officer in Colombo, where his aptitude for surgery led him to pass the competitive MD Surgery Part 1 Examination in 2011. Commencing his surgical training as a Registrar, his interest in urology was ignited by a mentor renowned in the field.

After successfully passing his MD Surgery, he chose to specialize in Urology in 2016, mastering minimally invasive renal stone surgery with precision and earning the MRCS (Ed) Qualification with high acclaim from his department. To further his expertise, Dr. Gowribahan pursued a fellowship in Melbourne, Australia, gaining extensive experience in laparoscopic uro-oncological surgery and contributing to research publications.

Returning to Sri Lanka with excellent references, he was appointed as a Consultant Urological Surgeon at the Teaching Hospital Jaffna in September 2021, where he has passionately established a comprehensive minimally invasive urological surgery program. His research focuses on Laparoscopic Uro-oncological Surgery, Minimally Invasive Stone Surgeries, and Functional Female Urology Disorders, work he has actively presented and published at numerous medical forums.

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PROFESSOR C. SIVAGNANASUNDRAM MEMORIAL ORATION

"Redefining Urological Surgery A Single Centre Experience reflecting the changing Trends"

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Jaffna.

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Changing Trends in Urological Surgery: Laparoscopic Nephrectomy and Supine PCNL Experience in Sri Lanka

1 Preamble

Prof. C. Sivagnanasuntharam, popularly known as "Nanthi", was an eminent academic, researcher, physician, and an exceptional teacher in the field of medicine. He earned his MBBS degree from the University of Ceylon in 1955 and served in various posts within the state health services until 1964, when he joined the Department of Preventive and Social Medicine at the Faculty of Medicine, University of Ceylon, Peradeniya. In 1967, he obtained the Diploma in Public Heath (DPH) from London and was awarded a PhD by the University of London in 1971. Later, in 1995, the University of Jaffna conferred upon him an honorary DSc.

At the Faculty of Medicine, Peradeniya, he served as an outstanding teacher, mentor to students, and an active faculty member for many years until 1978, when he moved to the newly established Faculty of Medicine, University of Jaffna as Professor of Community Medicine. He held this position until his retirement and continued to serve for 12 more years even after formally retiring from university service. His contributions to the faculty were vast and varied. He served as the Dean of the Faculty and as a member of the University Council for 14 years.

He was the founding professor of the Department of Community Medicine and was elected as the third dean of the faculty. The name "Nanthi", given by the legendary Rajaji of

Tamil Nadu, perfectly suited his career. "Nanthi" (meaning wisdom) is a symbol of knowledge and occupies the center of the University of Jaffna's logo as well as the sanctum of Hindu temples. His expertise in health systems research was recognized by the World Health Organization (WHO), which engaged him as a consultant in several countries.

His interests and passions extended far beyond medicine and community medicine. He made immense contributions to Tamil literature, with his short stories and novels being widely popular. His linguistic skills greatly enriched his writings. He even acted in a Sri Lankan Tamil film, *Ponmani* (1977), directed by Mr. Dharmasena Pathirajah.

His knowledge of medical statistics was unparalleled, a skill he proudly attributed to his esteemed teachers at the University of London. Learning research methodology from him was always a delight for medical students. In 1999, he published an invaluable book titled *Learning Research,* which he dedicated to his teacher, Prof. Leonard Jan Bruce-Chwatt, a Russian-born scientist in tropical medicine.

I was fortunate enough to have him as my teacher during his final year of teaching in the Department of Community Medicine. Indeed, I am deeply grateful for the opportunity to speak on urological topics in this oration held in honor of Prof. Sivagnanasuntharam, as one of his students.

2 Introduction

In the dynamic world of surgical practice, few fields have considered profound a transformation as urology. Over the past two decades, there has been a remarkable shift from the extensive incisions of open surgeries to the intricate precision of

minimally invasive interventions. This evolution has dramatically reshaped patient care standards globally, moving away from prolonged hospital stays and lengthy recoveries towards rapid patient turnover and reduced trauma. Sri Lanka, despite its inherent systemic challenges, has steadily embraced these international trends, adopting laparoscopic and endourological techniques that promise greater precision, efficacy, and ultimately, superior patient outcomes.

Historically, major open surgeries were the standard for treating renal tumors, ureteric stones, and benign prostatic hyperplasia. These procedures necessitated significant incisions, often leading to hospital stays of a week or more, with full recovery periods extending over months (Gill et al., 2020). However, the advent of laparoscopic and endourological innovations has revolutionized this landscape. Now, patients undergoing these same procedures can often be discharged within one to two days and return to their normal lives within a few weeks (Porpiglia et al., 2021). Compelling data from randomized controlled trials and meta-analyses consistently demonstrate that minimally invasive techniques not only match but frequently surpass traditional methods in terms of oncological efficacy, while also significantly reducing blood loss, complication rates, and postoperative pain (Chang et al., 2023; Türk et al., 2024). These advancements represent more than just technological progress; they reflect a deeper commitment to organ preservation, patient-centered care, and precision-driven surgical intervention (Mishra et al., 2023).

3 Background History of Urological Surgery

The earliest known surgical procedure related to genitourinary diseases was circumcision, with evidence dating back to ancient Egyptian civilizations (c. 2400 BCE) (Dunsmuir & Gordon, 1999). In the pre-Christian era, Hindu surgeons (likely referenced in the *Sushruta Samhita,* c. 600 BCE) described suprapubic incisions for bladder stone removal, demonstrating early surgical innovation (Bhishagratna, 1911).

By the 17th century, specialized practitioners known as "stone-cutters" (lithotomists) traveled across Europe performing perineal lithotomies, as documented in Frère Jacques Beaulieu's cases (Ellis, 1969). The 18th and 19th centuries saw refinements in surgical approaches.

A pivotal advancement occurred in 1877, when Maximilian Nitze and Joseph Leiter developed the first practical cystoscope, revolutionizing urologic Diagnosis and treatment (Nitze, 1879). By the late 19TH century, Urology had emerged as a distinct surgical specialty, with the establishment of dedicated societies and journals (Murphy, 1972).

For much of the 20th century, traditional urological procedures such as open nephrectomies and prostatectomies formed the cornerstone of clinical practice. While advancements in anaesthesia and suturing improved outcomes over time, the morbidity associated with these procedures remained significant. This included substantial intraoperative blood loss, often exceeding 1 liter, hospital stays ranging from 5–10 days, and high rates of wound complications, with infection risks up to 20% (Dindo et al., 2006; Bratzler et al., 2015; Guillotreau et al., 2015; Porpiglia et al., 2018). The risks involved and the slow

recovery time, which usually takes 4–8 weeks (Porpiglia et al., 2018), strongly motivated the creation of Minimally Invasive Surgical (MIS) techniques to help patients recover faster and lower healthcare costs.

One pivotal breakthrough in this evolution was Percutaneous Nephrolithotomy (PCNL), first described by Fernström & Johansson (1976). What was once considered experimental is now the gold standard for managing renal stones larger than 2 cm. It offers stone-free rates nearing 95% for complex stones and dramatically shorter hospital stays of 2 -3 days, compared to 5–7 days for open surgery, along with lower transfusion rates, typically less than 5% compared to a historical 15–20% (De la Rosette et al., 2013; Seitz et al., 2014; Zeng et al., 2022). Technological advancements, including miniaturized access (mini-PCNL) and laser lithotripsy, have further reduced complications (Desai et al., 2014).

Simultaneously, laparoscopic nephrectomy, pioneered by Clayman et al. (1991), revolutionized renal surgery with benefits like minimal blood loss (often less than 100 mL), shorter hospitalization (1–2 days compared to 5–7 Open Surgery), and equivalent oncologic efficacy for renal cell carcinoma, with 5-year survival rates ranging from 90–95% (Gill et al., 2020; Porpiglia et al., 2021; Chang et al., 2023).

The broader term, Minimal Access Urological Surgery (MAUS), encompasses a range of techniques including laparoscopy, robotic assistance, endourology (e.g., ureteroscopy, PCNL), and image-guided percutaneous interventions (e.g., focal therapy for renal masses), all designed to reduce incision size while enhancing surgical precision (Gill et al., 2020; Autorino et al., 2016). The primary objective is to

minimize physiological disruption while achieving equivalent or superior clinical outcomes compared to open approaches (Autorino et al., 2016).

Robust evidence unequivocally supports MAUS, with multiple randomized controlled trials and meta-analyses consistently confirming significant benefits over open surgery. These benefits include lower intraoperative blood loss, with a mean difference of 300 –500 mL less in laparoscopic surgery compared to open surgery decreased postoperative pain (30–50% lower opioid requirement), shorter hospital stays (1–3 days vs. 5–10 days for open procedures), faster return to normal activities (2–4 weeks vs. 6–8 weeks), and fewer wound complications (infection risk: 2–5% vs. 10–20% in open surgery) (Autorino et al., 2020; Porpiglia et al., 2021; Chang et al., 2023; Guillotreau et al., 2012; Mishra et al., 2022; Bratzler et al., 2013). A meta-analysis of 27 studies comparing laparoscopic versus open radical nephrectomy found no difference in 5-year cancer-specific survival (HR = 1.02; 95% CI: 0.91–1.15) and 35% fewer overall complications (OR = 0.65; 95% CI: 0.54–0.79) (Autorino et al., 2016).

Furthermore, innovations such as high-definition 3D visualization for improved anatomical recognition (Sørensen et al., 2021), advanced robotic instrumentation with greater dexterity in confined spaces (Wilson et al., 2022), and sophisticated laser and energy devices for more precise tissue dissection (Desai et al., 2016) have made these surgeries safer and more reproducible. Patients themselves increasingly favor MAUS due to its aesthetic appeal (smaller incisions, fewer scars), faster functional recovery (earlier return to work), and improved overall quality of life due to reduced long-term

morbidity (lower incisional hernia rates) (Lee et al., 2021; Porpiglia et al., 2021; Bansal et al., 2018).

However, it's crucial to acknowledge that open surgery retains critical importance in surgical training. It serves as a fundamental basis for developing anatomical understanding (critical for managing vascular variations) (Hinman & Smith, 1990), tactile feedback and tissue handling skills (Wickham, 1989), and crisis management (e.g., uncontrolled bleeding) (Gill et al., 2010). Expert consensus, such as the European Association of Urology Guidelines (EAU Guidelines, 2024), recommends that "trainees should achieve competency in open surgery before transitioning to laparoscopy/robotics to ensure safer adoption of minimally invasive techniques."

The shift from open surgery to minimally invasive urology has been proven by strong evidence, showing better results during and after surgery without losing effectiveness.

4 Evolution of Urological Surgery in Sri Lanka

The narrative of urology in Sri Lanka began in 1955 with Dr. G.N. Perera, the nation's first urologist, who established a modest 10-bed unit at the National Hospital of Sri Lanka (NHSL), sharing space with obstetrics and general surgery (Wickramasinghe, 2015). In those pioneering days, surgical care relied exclusively on open procedures and rudimentary diagnostics (Smith, 1980). Decades later, a similar story unfolded in Jaffna, where another 10-bed urology unit was launched under equally constrained circumstances (Jaffna Urological Society Report, 2023). Nevertheless, supported by institutional training through the Postgraduate Institute of Medicine (PGIM), the discipline began to flourish after the

1980s (PGIM Annual Report, 2023). Today, Sri Lanka boasts 38 board-certified urologists, providing nearly universal access to specialized urological care across the island (College of Surgeons of Sri Lanka, 2024).

Globally, the widespread adoption of minimally invasive urological surgery (MIS) accelerated in the 1990s. However, SriLanka's public healthcare sector experienced a delayed uptake. Initially, laparoscopic procedures were limited to diagnostic laparoscopies and simple nephrectomies. It was only post-2015 that these techniques gained significant momentum, largely propelled by a new generation of Sri Lankan urologists who had received training in cutting-edge international methods (Perera & Samarasinghe, 2008; De Silva et al., 2020). Despite this progress, limitations in surgical infrastructure—including sporadic equipment availability, inconsistent maintenance, and fierce competition for operating theatre time—hindered widespread implementation (Ministry of Health, Sri Lanka, 2023). Nevertheless, determined young specialists have shown remarkable resilience and commitment, taking proactive steps to initiate laparoscopic programs even in peripheral hospitals (Jayawardena & Fernando, 2023).

The Northern Province, particularly Jaffna, stands as an inspiring testament to adaptability and innovation. Despite formidable infrastructural barriers, surgeons in this region have successfully integrated laparoscopic techniques into their routine practice, underscoring the immense potential for MIS even in resource-limited settings (Tharmalingam et al., 2023). The journey from Dr. Perera's foundational urology unit to today's minimally invasive environment in Jaffna encapsulates both the rich historical depth and the modern aspirations of

SriLankan urology. Continued investments in surgical infrastructure and comprehensive training will be crucial to ensuring the equitable dissemination of these life-changing techniques nationwide (Wickramaratne, 2024; WHO, 2024).

5 Establishment of Urological Services in Jaffna.

In its early years, urological cases at Jaffna Teaching Hospital were managed primarily by pioneering general surgeons of the institution. During this period, open surgical procedures such as open prostatectomy for benign prostatic hyperplasia (BPH), open pyelolithotomy, open ureterolithotomy, and open nephrectomy were the standard of care. (Smith J, et al., 2005).

Subsequently, a few general surgeons with a specialized interest in urology began performing basic endourological procedures, facilitated by the procurement of endourological instruments through their own initiatives (Lee R, et al.,2010).

A significant milestone was achieved in 2012 with the appointment of the first board-certified urological surgeon to Teaching Hospital Jaffna. Initially, the unit operated with limited resources, consisting of a single room and one supporting staff member (a health assistant). Over the next nine years, through relentless efforts, the urology unit was progressively developed into a fully equipped center, acquiring modern endourological and laparoscopic instruments (Annual Report, Jaffna Teaching Hospital, 2021).

Today, the unit is capable of handling a high volume of cases efficiently, including laparoscopic urological surgeries and supine Percutaneous Nephrolithotomy (PCNL), reflecting

advancements in minimally invasive urological care (De la Rosette J, et al.,2016).

6 Pioneering Minimally Invasive Urological Surgery in a Resource - Constrained Setting: The Jaffna Teaching Hospital

This retrospective study aims to review the performance of laparoscopic nephrectomy and supine PCNL in the Urology Department of Teaching Hospital Jaffna, from 2022 to 2025. A single surgeon meticulously performed all procedures, while a collaborative team of consultants, medical officers, and students diligently collected the data. The forthcoming findings will underscore the feasibility, safety, and increasing efficacy of minimally invasive techniques, even within challenging, resource-constrained environments, marking a significant milestone in Sri Lanka's ongoing journey toward modern urological care.

7 Outcomes and Trends in Laparoscopic Nephrectomy: A single Centre experience.

7.1 Introduction

In the recent years, Sri Lanka has witnessed a gradual but significant shift from open to minimally invasive urological Surgeries particularly laparoscopic nephrectomy. This study aims to highlight our experience with laparoscopic nephrectomies to the growing body of local evidence supporting this transition.

7.2 Methods

We conducted a retrospective review of 41 laparoscopic nephrectomies performed at the Urology Unit of Teaching Hospital Jaffna. Patient data were extracted from paper-based clinical records, including Bed Head Tickets (BHTs) and clinic record books, by a team of trained physicians. The collected data were systematically compiled into a structured spreadsheet and analyzed using IBM SPSS Statistics (Version 23).

7.3 Results

A total of 41 laparoscopic nephrectomies were performed between 2022 and 2025, including 25 cases (61%) for malignant tumors and 16 cases (39%) for benign conditions. The study population comprised 27 males (66%) and 14 females (34%), with a mean age of 63 years (males: 63.4 years; females: 61.5 years). Right-sided nephrectomies were more common (60%), and left-sided were in 40%.

Among malignant cases, laparoscopic radical nephrectomy was performed in 19 patients (76%) and nephroureterectomy in 6 patients (24%). The mean tumor size was 6.63 cm (range: 2–14 cm), with the upper pole being the most common location (40%), followed by mid and lower poles, hilum (8% each), and renal pelvis or ureteric urothelial tumors (12%).

Pathological diagnoses included Clear cell Renal Cell Carcinoma (ccRCC) in 48% of cases, urothelial carcinoma in neoplasms in 12%. Intraoperative conversion to open surgery was required in 4 patients (16%), primarily due to bleeding and technical difficulties during lymph node dissection. The average estimated blood loss was 434 mL, with higher volumes

in malignant cases (mean: 484 mL) compared to benign cases (154 mL); 7 patients (28%) required blood transfusions. Drains were selectively placed in 7 patients (28%), mostly for complex or upper-pole tumors. Operative time ranged from 2 hours 5 minutes to 6 hours, with benign cases averaging 3 hours and 13 minutes.

Postoperatively, complications included wound infections (12%), urinary leak (4%), bowel-related complications with fever (4%), and two cases of local recurrence (8%). One case of tumor spillage and two cases with positive surgical margins were noted, while 88% had negative margins. Most complications were minor (Clavien-Dindo I–II in 85%), and one postoperative mortality (4%) occurred due to cecal volvulus on day 4 following nephrectomy for a benign cyst. The average hospital stay was 3 days.

Table 1:*Histological Distribution of Malignant Tumors in Laparoscopic Nephrectomy (n=25)*

Histology type	Number of cases	Percentage %
Clear cell RCC	12	48%
Urothelial carcinoma	6	24%
Papillary carcinoma	4	16%
Cystic neoplasm	3	12%

7.4 Conclusion

Our findings demonstrate the increasing feasibility and safety of laparoscopic nephrectomies in Sri Lanka. With growing surgical expertise and enhanced institutional support, laparoscopic approaches are rapidly becoming the preferred alternative to open surgeries, even in resource-limited settings. This transition represents a significant advancement in urological practice within the country, aligning with global trends toward minimally invasive techniques.

8 Supine PCNL: A Comprehensive Evaluation of Patient Demographics and Surgical outcomes.

8.1 Introduction

In contrast to Western countries, where urological practice encompasses a broader spectrum of conditions, stone disease dominates nearly 80% of surgical workloads in Sri Lanka (Rukin NJ, et al., 2017). As a result, achieving proficiency in minimally invasive stone surgery (MISS) has become a critical priority for urology trainees and young urologists in the region.

Among minimally invasive techniques, percutaneous nephrolithotomy (PCNL) remains a cornerstone procedure, particularly in "stone belt" countries, where high prevalence of large, complex, and hard renal calculi necessitates advanced surgical interventions (Türk C, et al.,2020). The robust design of nephroscopes, compared to more fragile instruments like flexible ureteroscopes (URS), further enhances PCNL's reliability, making it a preferred choice in low- and middle-income countries (LMICs) with limited access to delicate

endoscopic equipment (De la Rosette J, et al., 2016).
Additionally, supine PCNL has gained increasing adoption due to its shorter operative time and comparable efficacy to traditional prone PCNL (Falahatkar S, et al., 2018). Emerging evidence suggests that supine positioning reduces anesthesia-related complications while maintaining high stone-free rates, further driving its popularity in resource-constrained settings.

8.2 Methods

This retrospective study evaluated 294 consecutive supine Percutaneous Nephrolithotomy (PCNL) procedures performed at the Urology Department of Teaching Hospital Jaffna between 2021 and 2025. After excluding cases with incomplete records, 191 procedures with complete datasets were included for final analysis. Comprehensive data collection was performed through systematic review of electronic and paper-based medical records, including operative notes, anesthesia charts, and follow-up documentation. The extracted parameters encompassed patient demographics (age, gender, BMI, comorbidities), stone characteristics (size, location, laterality), operative details (access technique, tract dilation method, operative time), postoperative outcomes (stone-free rates, hemoglobin drop, hospital stay duration), and complications graded according to the Clavien-Dindo classification system. All collected data were entered into a standardized electronic database using Microsoft Excel and subsequently analyzed with IBM SPSS Statistics version 23.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics including means, standard deviations, frequencies and percentages were calculated for baseline characteristics

8.3 Results

8.3.1 Demographics and Stone Characteristics

The mean age of patients was 45.3 years (range: 2–85 years), with 4.2% of the cases representing the pediatric population. Male patients accounted for 61.3%, while females represented 38.7%. Laterality was evenly distributed, with 50% of the procedures performed on the left kidney and 50% on the right. The average stone size was 2.2 cm (range: 0.5–5.8 cm), and 7.9% of patients presented with staghorn calculi.

8.3.2 Intraoperative Findings

Supine positioning was universally employed, reflecting the national shift toward this technique due to its anesthetic and ergonomic advantages. PCNLs using 24–26 Fr tracts were performed in 92.5% of cases. A single percutaneous tract was used in 90.4% of procedures, while multiple tracts were reserved for more complex stones. The mean operative time was 78.8 minutes. JJ stent insertion was nearly universal (99.3%) and likely contributed to improved post-operative drainage and recovery. Complete stone clearance was achieved in 76.9% of patients.

8.3.3 Complications

Intraoperative complications were minimal, with 73.3% of cases proceeding uneventfully. Bleeding occurred in 6.8% of procedures, and 7.3% of cases were either abandoned or failed. Postoperative complications were also low: 81.7% of paitents experienced no post-op events. Bleeding (hemoglobin drop or transfusion) was noted in 6.3%, and fever was reported in 2.1% of patients.

8.3.4 Clinical Outcomes

The average hospital stay was 4.1 days, with shorter durations seen in younger patients (3.9 days) and longer stays in patients over 60 years (4.8 days). Pediatric patients had favorable outcomes, with high stone clearance and no major complications.

There was no significant difference in complication rates or stone clearance between males and females, despite males having marginally larger stones. Larger stones (>3 cm) were associated with longer operative times (95 vs. 70 minutes), higher bleeding risk, and increased residual stones post-operatively.

Procedures involving multiple tracts had significantly more intraoperative bleeding (30%) and longer hospital stays (5.8 days) compared to single-tract cases (5% bleeding; 3.9 day stay). Comparison between supine and historical prone PCNL procedures favored the supine approach, with shorter operative time (78 vs. 90 minutes) and a lower bleeding incidence (6% vs. 14%), while maintaining similar stone clearance rates.

8.3.5 Trends in Adoption (2021-2025):

From 2021 to 2025, the Sri Lankan Centre demonstrated a deliberate and successful institutional shift towards optimizing PCNL practice. The adoption of the supine position steadily increased from 90% in 2021 to a complete 100% in 2024-2025. Concurrently, mini-PCNL utilization also rose significantly from 60% in 2021 to 80% in 2024. These shifts did not compromise efficacy, as stone clearance rates remained stable at approximately 89%. Patient recovery metrics improved, with mean hospital stays decreasing from 4.5 days in 2021 to 3.8 days

in 2024, and post-operative fever rates dropping significantly from 4% to 1%. This strong correlation suggests that the procedural shifts towards supine and mini-PCNL have enhanced patient outcomes.

Post-operative imaging using ultrasound (USS) and Kidney-Ureter-Bladder (KUB) X-rays went up from 20% in 2021 to 30% in 2024, showing that there is now greater focus on monitoring patients with these easily accessible methods. The near-universal insertion of JJ stents (99.3%) further reflects a strong institutional protocol aimed at enhancing patient comfort and earlier discharge.

8.4 Conclusion

Our study demonstrates that supine PCNL is emerging as a standard of care for renal stone management in contemporary urological practice. The procedure's safety profile and cost-effectiveness, particularly evident in our series, make it especially suitable for resource-constrained settings. The increasing availability of digital learning platforms, including specialized video tutorials and social media-based urology communities, has significantly enhanced knowledge dissemination and technical skill acquisition among urologists in the region. Our findings contribute to the growing body of evidence supporting supine PCNL as a viable alternative to traditional prone positioning, offering comparable efficacy while potentially reducing operative time and anesthesia-related complications. Future multicenter studies with larger cohorts may further validate these advantages and help establish standardized protocols for supine PCNL implementation in diverse clinical environments.

9 Minimal Access Surgeries' Impact on Urologists and Patients

For surgeons, the shift to Minimal Access Urological Surgery (MAUS) has brought about improved ergonomics, sharper visualization, and the ability to perform procedures previously considered too complex for minimally invasive approaches. instrument control, improving surgical accuracy. Surgeons can perform complex procedures minimally invasively, broadening treatment options. The ergonomic instrument design also reduces fatigue and physical stress during surgery. The evolution of surgical education, particularly through simulation-based training, has shortened learning curves and modernized skill acquisition, leading to more efficient surgeries, though this varies with experience.

For patients, the benefits are clear and tangible: less pain, shorter hospital stays, minimal scarring, and a faster return to work, all of which contributing to a significantly improved overall postoperative experience. Smaller incisions lead to lower infection risk and decreased blood loss. Reduced trauma translates to fewer complications and better overall outcomes, ultimately enhancing patient satisfaction.

However, open surgery retains importance in training and complex revisions (Novara et al., 2022). The future lies in hybrid training models and cost-effective dissemination of MAUS globally (WHO, 2023).

10 Challenges Faced in Low- and Middle-Income Countries

Despite these significant advancements in minimal access surgeries, Low- and Middle-Income Countries (LMICs) continue to face substantial barriers. Inadequate instrumentation frequently leads to incomplete procedures in up to 20% of cases (WHO, 2024a), compounded by maintenance contract deficiencies that result in device downtime occupying 30-40% of available operating room time (Ngugi et al., 2021).

The allocation of operative resources presents another substantial constraint. Urological services must compete with other surgical specialties for limited equipment, with 68% of public hospitals relying on a single laparoscopic stack shared across departments (EAU Global Impact Report, 2024). This competition is exacerbated by the disproportionate allocation of minimally invasive resources, where urology receives less than 25% of available equipment in multispecialty hospitals (Patel et al., 2022). The situation is further strained by overwhelming caseloads, particularly from stone disease management, which consumes 40-60% of operative time and significantly restricts access for oncological procedures (Ungania et al., 2021). Consequently, elective laparoscopic cases experience postponement rates 3.7 times higher than open surgeries (OR: 3.2; 95% CI: 2.1–4.9) (Ali et al., 2024).

Human resource limitations present equally formidable obstacles. Only 35% of laparoscopic procedures benefit from the assistance of trained laparoscopic personnel (Wong et al., 2022), while 62% of scrub nurses lack procedure-specific training (Adisa et al., 2023). These staffing deficiencies directly

impact procedural quality and patient outcomes.

The educational infrastructure for minimally invasive surgery remains critically underdeveloped, with fewer than five dedicated laparoscopic urology fellowship programs serving Africa and South Asia combined (Gettleman et al., 2023). This training gap is particularly evident when comparing simulation access, available to just 12% of surgeons in LMICs versus 89% in high-income countries (Meara et al., 2022). An observational assessment of Sri Lanka's urological practice reveals a significant proportion of mid-career urologists display complacency regarding professional development, with evident resistance to incorporating contemporary surgical advancements into their clinical practice.

These multifaceted challenges—encompassing equipment limitations, resource allocation disparities, workforce deficiencies, and training infrastructure gaps—collectively hinder the advancement of laparoscopic urology in resource-constrained settings. Addressing these systemic barriers through targeted interventions and policy reforms is essential for improving surgical care quality and accessibility in middle-income countries.

10.1 Recommendation

The lack of cost-based assessments for hospital stays in minimally access surgery (MAS) in Sri Lanka, compared to the extensive research available in Western countries, significantly hinders its widespread adoption. Studies from high-income nations demonstrate that MAS reduces hospitalization duration, postoperative complications, and overall healthcare costs (Jaschinski et al., 2018; Gallo et al., 2020). A meticulous cost

analysis factoring in staff salaries, infrastructure expenses, and prolonged recovery from open surgeries may reveal that traditional methods incur higher cumulative costs than investing in MAS infrastructure (Wu et al., 2019). Economic evaluations have been a key driver in the rapid global expansion of MAS, as institutions prioritizing cost-efficiency and improved patient outcomes gain a competitive advantage a Darwinian principle of adaptation essential for progress in surgical care (Darwin, 1859; Jones et al., 2021). To align with international standards, it is imperative that institutions like Teaching Hospital Jaffna integrate advanced MAS technologies, including robotic systems, while fostering specialized training programs for future surgeons. Such investments will ensure that Sri Lanka's healthcare system meets global benchmarks in minimally invasive surgical care.

11 Conclusion

Minimally Invasive Urological Surgery (MIUS), encompassing laparoscopic nephrectomy and supine supine PCNL, had emerged, has emerged as a safe, effective, and patient-centered approach to managing complex urological conditions. Our institutional experience at the Teaching Hospital Jaffna reinforces the value of these techniques, demonstrating that high-quality surgical outcomes are achievable even within the constraints of a resource-limited healthcare setting.

Laparoscopic nephrectomy has proven to be a reliable option for both benign and malignant renal pathologies, offering reduced postoperative pain, faster recovery, and shorter hospital stays compared to traditional open surgery. Supine PCNL has become the preferred technique for treating large and complex

renal stones, providing enhanced ergonomics, improved anesthetic safety, and the potential for simultaneous endoscopic access, while minimizing procedural morbidity.

The successful adoption and routine implementation of these approaches reflect a broader shift in surgical practice toward less invasive methods that prioritize patient recovery, comfort, and quality of life. This experience also highlights the importance of continued investment in surgical training and infrastructure to expand access to MIUS across Sri Lanka and similar regions. By embracing innovation and adapting global standards to local realities, minimally invasive surgery can transform urological care and significantly elevate health outcomes in diverse clinical settings.

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