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Radical cystectomy for bladder cancer in Sub-Saharan Africa: techniques, challenges, and survival outcomes: a comprehensive review

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Abstract

Radical cystectomy (RC) with urinary diversion remains the gold-standard treatment for muscle-invasive bladder cancer (MIBC), yet its implementation in Sub-Saharan Africa is hindered by late-stage presentation, limited surgical expertise, and inadequate perioperative care. These challenges contribute to higher morbidity and poorer survival outcomes compared to high-income regions. Additionally, the high prevalence of schistosomiasis-associated squamous cell carcinoma, disparities in multidisciplinary cancer care, and the burden of comorbidities further complicate treatment.

This review examines RC techniques practiced in Africa, from open to minimally invasive approaches, assessing their feasibility within resource-limited settings. It explores challenges specific to the region, highlighting the impact of infrastructure gaps, limited access to neoadjuvant and adjuvant therapies, and variations in surgical training. Addressing these barriers requires urgent investment in oncology infrastructure, expanded access to multimodal therapy, and early detection strategies. Optimizing perioperative management and promoting cost-effective urinary diversion techniques are critical to improving bladder cancer outcomes in the region.

Keywords Complications, Survival outcomes, Radical cystectomy (RC), Muscle invasive bladder cancer (MIBC)

Introduction

Muscle-invasive bladder cancer (MIBC) is a significant public health concern worldwide, with radical cystectomy (RC) remaining the gold standard treatment for this aggressive disease [1]. RC involves the removal of the bladder and surrounding organs with urinary diversion, making it a complex procedure associated with substantial morbidity and mortality [2]. Despite advances in surgical techniques and perioperative care, the outcomes of RC vary significantly across different regions due to differences in healthcare infrastructure, patient demographics, and disease presentation [3, 4].

In Africa, the burden of bladder cancer is rising due to factors such as increasing tobacco use, exposure to industrial chemicals, and chronic infections like schistosomiasis, which remains endemic in several regions [5, 6]. A key distinction in bladder cancer treatment in Africa is the high prevalence of squamous cell carcinoma (SCC), particularly in areas where schistosomiasis is widespread [7]. Given the unique epidemiology of bladder cancer in the region, understanding its aetiology, risk factors, and

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clinical presentation is crucial for improving diagnosis, treatment, and patient outcomes.

Histological subtypes, epidemiology, and clinical presentation

Bladder cancer encompasses multiple histological subtypes, the most common in Africa being squamous cell carcinoma, followed by urothelial carcinoma(UC) and adenocarcinoma [7]. The aetiology of UC is strongly associated with smoking and occupational exposure to carcinogens (aromatic amines), such as those found in the dye industry [7]. In contrast, SCC is commonly linked to chronic bladder irritation, particularly due to schistosomiasis, which leads to chronic inflammation and metaplastic changes in the bladder epithelium [5].

The proportion of squamous cell carcinoma and urothelial carcinoma varies significantly across different African countries. In Tanzania, regions near inland freshwater lakes report a higher prevalence of SCC compared to areas further inland, likely due to the endemic nature of schistosomiasis in these regions [8, 9]. In South Africa, SCC is more prevalent among the native Black population, accounting for up to 53% of bladder cancer cases, while its prevalence is significantly lower among Asian (18%), coloured (6%), and white (2%) populations [1, 9]. These disparities may be attributed to genetic predisposition, socioeconomic factors, and behavioural differences.

SCC tends to present at a younger age, often affecting individuals in their 40s and 50s, whereas UC typically occurs in older individuals, particularly those over 60 years of age [7]. The earlier onset of SCC may contribute to its more aggressive nature, leading to poorer outcomes due to delayed medical consultation and late-stage presentation [2]. Unlike UC, which is more common in high-income countries and responds well to chemotherapy, SCC is largely resistant to systemic therapies. UC is typically treated with transurethral resection of the bladder tumour (TURBT), often combined with chemotherapy or immunotherapy, with or without radiotherapy, depending on tumour grade [8]. In contrast, SCC is radio- and chemoresistant, making radical cystectomy the primary treatment approach [10, 11].

The clinical presentation of UC typically includes painless haematuria, whereas SCC often presents with painful haematuria associated with irritative symptoms, necroturia, or a bladder mass [12, 13]. Like many urological diseases in developing countries, SCC tends to present late, often when the disease has already invaded the muscle layer [14]. In contrast, UC is frequently diagnosed at earlier stages, with only mucosal involvement [15, 16]. This discrepancy is partly due to better access to urology services and cancer screening programs in developed countries.

In terms of gender distribution, SCC predominantly affects younger males, while UC is more common in older individuals, with a higher proportion of female patients [14]. Survival outcomes also differ, with UC having a better five-year survival rate (~90%) compared to SCC (~70%) [17]. Up to 27% of SCC cases may be fixed and inoperable, particularly when located below the intraureteric bundle of Mercier [11, 17].

The management of MIBC in Africa is further complicated by resource constraints, limited access to specialized care, and the frequent late-stage presentation of the disease [18]. The high prevalence of SCC in schistosomiasis-endemic regions presents unique treatment challenges, distinct from UC. Healthcare disparities, gender-related treatment delays, and restricted access to multimodal therapy further exacerbate the complexity of MIBC management in Africa [18, 19]. Addressing these challenges requires a focus on early detection, prevention strategies, and improved access to surgical and oncological care.

Indications for radical cystectomy

Radical cystectomy is primarily indicated for the treatment of muscle-invasive bladder cancer (MIBC), which accounts for approximately 25% of all bladder cancer cases at the time of diagnosis [20]. The procedure is recommended for patients with clinical stage T2-T4a, N0-Nx, M0 bladder cancer, as it offers the best chance for long-term survival in these cases [21].

RC can be performed for NMIBC or metastatic Urothelial carcinoma of the bladder (mUCB). In the NMIBC setting, RC is most commonly performed for high-risk disease (high grade Ta/T1 tumours of carcinoma in situ (CIS) that have recurred or persisted after adequate intravesical Bacillus Calmette-Guerin (BCG) therapy or failure of other conservative treatments [21]. The risk of progression to MIBC is high in this situation, salvage treatment options are otherwise relatively ineffective, and RC represents an effective curative intervention to prevent progression to MIBC [10, 22].

High grade recurrences after induction BCG (if recurrence is T1) or induction and one round of maintenance BCG (if recurrence is Ta or CIS) are considered "BCG-unresponsive", in addition to high grade tumors that recur within 6 months (Ta/T1) or 12 months (CIS) after the last dose of BCG if there has been a previous disease-free period. RC is the standard of care for BCG-unresponsive high risk NMIBC [23, 24].

RC is also indicated as first line therapy (i.e., without prior BCG therapy) of very high risk NMIBC. Features that make a NMIBC very high risk include: presence of lymphovascular invasion, variant histology (e.g.,micropapillary, sarcomatoid, or plasmacytoid histology), extensive invasion into the lamina propria, large

high grade T1 tumours (> 5 cm), persistent T1 tumour on re-resection and presence of disease in the prostatic urethra [23, 24]. Palliative RC in an attempt to control bleeding and local symptoms is rarely indicated due to the morbidity of the surgery and the limited life expectancy of patients with mUCB. However, this could change over time as new treatment options, including immune checkpoint blockade, are introduced [25].

RC is also considered for patients with locally advanced or recurrent bladder cancer following partial cystectomy or transurethral resection of bladder tumour when salvage therapy is necessary. Furthermore, selected cases of bladder cancer with variant histologies, such as micropapillary, plasmacytoid, and sarcomatoid subtypes, may warrant early RC due to their aggressive nature and poor response to less radical treatments [3, 26]. The decision to perform RC must be individualized, taking into account the patient's overall health, comorbid conditions, and personal preferences (Fig. 1). The timing of surgery is also critical, as delays in performing RC for appropriate candidates can adversely impact oncologic outcomes [27, 28].

Surgical techniques

Radical cystectomy involves the en bloc removal of the bladder along with adjacent organs as indicated, and regional lymph nodes. In males, this includes the excision of the prostate and seminal vesicles, while in females, it may involve the removal of reproductive organs such as the ovaries, fallopian tubes, uterus, and the anterior 1/3rd of the vagina (anterior exenteration) to achieve optimal oncologic outcomes [1, 2]. Surgical approaches to RC include open, laparoscopic, and robotic-assisted techniques.

Open radical cystectomy (ORC) remains the most widely performed method in Sub-Saharan Africa due to its relative accessibility and familiarity among surgeons [29]. However, it is associated with substantial perioperative morbidity, including significant blood loss, prolonged hospital stays, and increased postoperative complications. Partial cystectomy, which spares the prostate or supratrigonal region while preserving pelvic lymph nodes, is rarely indicated for muscle-invasive disease and is generally considered a suboptimal oncologic approach [14]. Simple cystectomy, typically reserved for benign conditions or palliative care, does not provide curative intent in bladder cancer management.

Minimally invasive techniques, including laparoscopic radical cystectomy (LRC) and robotic-assisted radical cystectomy (RARC), have demonstrated advantages in reducing perioperative complications and improving recovery times. However, their adoption in Sub-Saharan Africa remains limited due to constraints in surgical training, infrastructure, and equipment availability [30,

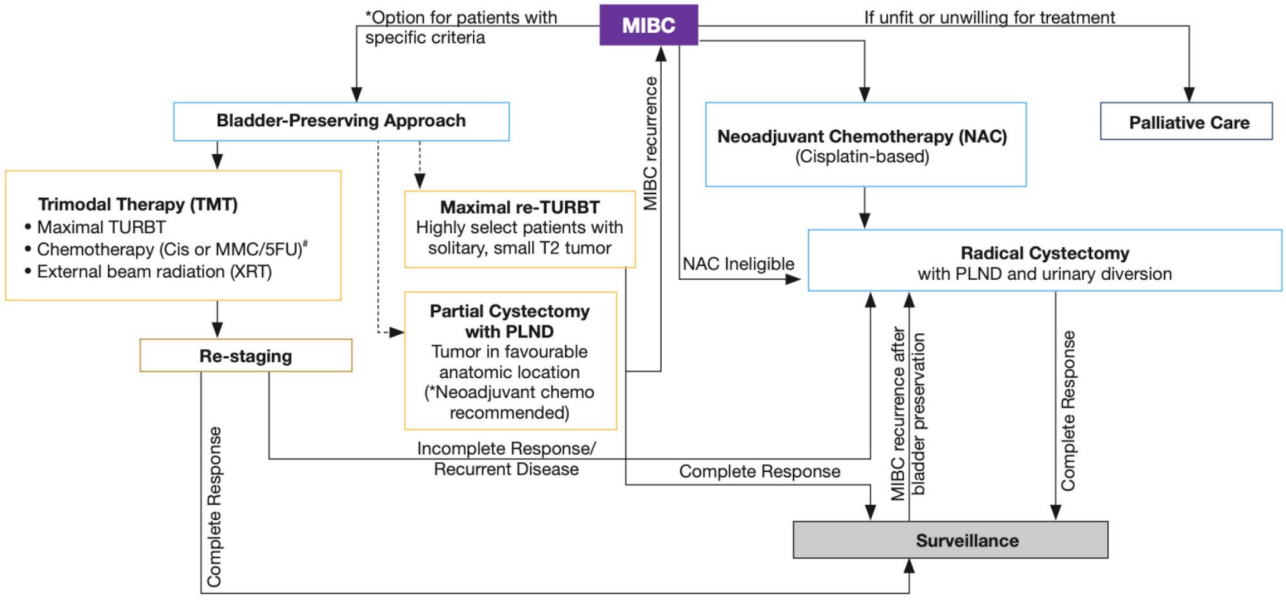

Fig. 1 This figure has been adapted from the AUA guidelines for muscle-invasive bladder cancer (MIBC) therapy
Upon diagnosis of non-metastatic, muscle-invasive bladder cancer, the recommended treatment for patients is neoadjuvant chemotherapy (NAC) followed by radical cystectomy and pelvic lymph node dissection (PLND). Surgery alone may be offered to patients who are ineligible for or who decline NAC, with radical cystectomy potentially followed by adjuvant chemotherapy. Trimodal therapy (TMT), as part of a bladder-preserving approach, is another option for select patients. However, if TMT fails, radical cystectomy remains a viable option for salvage therapy
Note:Option for patients with solitary tumors ≤ 5 cm, absence of hydronephrosis, absence of extensive carcinoma in situ (CIS), good bladder function, or those who are unfit for or decline cystectomy
#Note: Cis or MMC/5FU = cisplatin or mitomycin C and 5-fluorouracil

31]. While RARC is increasingly regarded as the gold standard in high-income countries due to its superior precision and reduced morbidity, the prohibitive cost of robotic systems and the need for specialized expertise restrict its widespread implementation in resource-limited settings [29].

Ongoing efforts to expand access to minimally invasive radical cystectomy in Africa focus on capacity-building initiatives, including surgical training programs, investment in laparoscopic infrastructure, and international collaborations aimed at reducing disparities in surgical oncology outcomes [19]. The integration of cost-effective innovations, alongside structured mentorship programs, may facilitate the gradual adoption of advanced techniques, ultimately improving bladder cancer care across the region. (Table 1).

Pelvic lymph node dissection

Pelvic lymph node dissection (PLND) is an integral component of RC, offering critical staging information and potential therapeutic benefits. The extent of PLND varies from limited to extended dissections. Limited PLND typically involves the removal of lymph nodes in the obturator fossa, while extended PLND extends to the common iliac bifurcation and presacral nodes [32, 33].

Evidence suggests that extended PLND improves survival outcomes in patients with muscle-invasive bladder cancer, even in cases where lymph node metastases are undetected preoperatively [22]. However, the increased extent of PLND is associated with higher perioperative morbidity, including lymphocele formation and vascular injury [34].

In sub-Saharan Africa, the use of PLND is often limited to standard dissections due to resource constraints and limited surgical expertise. Initiatives to promote the adoption of extended PLND, particularly in tertiary centres, could improve staging accuracy and survival outcomes in the region [6, 28].

Urinary diversion options

Urinary diversion is an essential component of radical cystectomy and is classified into incontinent and continent diversions. The choice of diversion depends on patient suitability, surgical expertise, and resource availability.

Incontinent diversion

The ileal conduit remains the most widely used incontinent urinary diversion worldwide, particularly in Sub-Saharan Africa, due to its technical simplicity, lower perioperative morbidity, and reduced long-term management requirements. This method involves isolating a segment of the ileum to serve as a conduit for urine, which is then directed to an abdominal stoma. Despite its advantages, complications such as stomal stenosis, urinary tract infections, and peristomal skin irritation necessitate long-term follow-up and patient education [35, 36]. Additionally, studies suggest that ileal conduits may have a lower risk of metabolic complications compared to continent diversions, further supporting their widespread use in low-resource settings [37, 38].

Continent diversion

Continent urinary diversions, such as orthotopic neobladders and the Mainz Pouch II, are increasingly utilized in East African centers for both men and women. These approaches aim to improve patient quality of life by allowing controlled voiding, either through the native urethra (neobladder) or a catheterizable stoma (Mainz Pouch II) [29].

The orthotopic neobladder, constructed from an ileal or ileocecal segment, has demonstrated favorable long-term functional outcomes in appropriately selected patients [39, 40]. However, its complexity, requirement for postoperative training, and risks of metabolic acidosis, nocturnal incontinence, and voiding dysfunction have limited its widespread adoption in resource-limited settings [41].

The Mainz Pouch II, which utilizes the detubularized cecum and ascending colon, has gained popularity in East Africa due to its technical feasibility and lower risk of urinary incontinence compared to neobladders [8]. This diversion provides reliable continence while avoiding the need for a catheterizable stoma, making it a cost-effective option in regions with limited access to long-term urological care [42]. Nevertheless, metabolic disturbances and the need for nocturnal voiding remain challenges that necessitate careful patient selection and follow-up [43].

Alternative and expanding access to urinary diversions

Cutaneous ureterostomy and percutaneous nephrostomy tube placement, while largely abandoned in high-income settings, remain viable alternatives for select patients in resource-constrained environments. These urinary diversions are particularly suited for elderly or frail patients, those with advanced or metastatic disease requiring palliative care, or cases where extensive bowel resection is contraindicated. Although these approaches are technically simpler and less invasive, they are associated with higher risks of long-term complications, including progressive renal deterioration, recurrent urinary tract infections, and obstruction. This underscores the need for structured follow-up and timely intervention to optimize patient outcomes [44, 45].

While incontinent diversions remain the mainstay of post-cystectomy reconstruction in Sub-Saharan Africa, the increasing utilization of continent diversions such as

Table 1 Comparison of Radical Cystectomy Techniques. This table compare the different techniques used for radical cystectomy, their complications, and survival outcomes, both in Sub-Saharan Africa and other regions

Technique	Description	Survival Outcomes (Sub-Saharan Africa)	Complications (Sub-Saharan Africa)	Survival Outcomes (Other Regions)	Complications (Other Regions)
Open Radical Cystectomy	Traditional open surgery technique	**5-Year Survival Rate**: 25–40% (varies)	**Infectious Complication**: - UTIs - Wound infections - Sepsis **Hemorrhagic Complications**: - Bleeding **Urinary Diversion-Related Complications**: - Urine leakage - Stomal complications **Gastrointestinal Complications**: - Ileus - Bowel obstruction **Cardiovascular Complications**: - Cardiac arrhythmias - Hypotension **Metabolic Complications**: - Electrolyte imbalances **Wound Healing Issues**: - Delayed healing	**5-Year Survival Rate**: 60–75% (varies by stage and health status) **Overall Survival**: Better outcomes in high-income settings due to better perioperative care	**Infectious Complications**: - UTIs - Wound infections - Sepsis **Hemorrhagic Complications**: - Intraoperative bleeding - Postoperative hemorrhage **Urinary Diversion-Related Complications**: - Leaks - Stomal issues **Cardiovascular Complications**: - Arrhythmias - Hypotension **Wound Healing Issues**: - Infection - Delayed healing
Laparoscopic Cystectomy	Minimally invasive procedure with smaller incisions	**5-Year Survival Rate**: 45–65% (less data available)	**Infectious Complications**: - UTIs - Port site infections - Sepsis **Hemorrhagic Complications**: - Bleeding **Urinary Diversion-Related Complications**: - Leaks - Stomal issues **Cardiovascular Complications**: - Hypotension **Gastrointestinal Complications**: - Ileus - Bowel perforation **Metabolic Complications**: - Electrolyte imbalances	**5-Year Survival Rate**: 60–80% (varies by stage and comorbidities) **Overall Survival**: Comparable to open cystectomy but with shorter recovery times and less blood loss	**Infectious Complications**: - UTIs - Port site infections **Hemorrhagic Complications**: - Intraoperative bleeding (difficult to control) **Urinary Diversion-Related Complications**: - Stomal prolapse **Thromboembolic Complications**: - DVT **Gastrointestinal Complications**: - Bowel injury **Metabolic Complications**: - Electrolyte imbalance
Robot-Assisted Cystectomy	Use of robotic systems for enhanced precision	**5-Year Survival Rate**: 50–70% (limited data)	**Infectious Complications**: - UTIs - Wound infections (port site) - Sepsis **Hemorrhagic Complications**: - Bleeding **Urinary Diversion-Related Complications**: - Leaks - Stomal issues **Cardiovascular Complications**: - Hypotension **Gastrointestinal Complications**: - Ileus - Bowel injury **Metabolic Complications**: - Electrolyte imbalance **Wound Healing Issues**: - Delayed healing	**5-Year Survival Rate**: 65–85% (similar to laparoscopic cystectomy) **Overall Survival**: Similar to laparoscopic, with faster recovery and less blood loss	**Infectious Complications**: - UTIs - Port site infections **Hemorrhagic Complications**: - Intraoperative bleeding **Urinary Diversion-Related Complications**: - Leaks - Stomal prolapse **Gastrointestinal Complications**: - Bowel injury **Metabolic Complications**: - Electrolyte imbalances **Neurological Complications**: - Nerve injuries (rare)

the Mainz Pouch II and orthotopic neobladder highlights the need for enhanced surgical training and resource allocation. Long-term comparative studies assessing functional outcomes, complication rates, and cost-effectiveness in low-resource settings are essential for guiding policy and optimizing patient care [46].

Challenges in radical cystectomy implementation

Availability of radical cystectomy centers in Africa

Radical cystectomy (RC) remains a highly specialized procedure, and only a limited number of centers in Sub-Saharan Africa offer this service due to a shortage of trained urologists, inadequate surgical infrastructure, and resource constraints [19]. Most high-volume RC procedures are performed in tertiary referral hospitals located in major urban centers, leaving many patients in rural areas with limited access to timely surgical care. The lack of decentralized urologic services contributes to significant treatment delays, disease progression, and poorer patient outcomes [47].

Several key institutions across Africa offer specialized urologic oncology services, including radical cystectomy (Table 3). However, due to a severe shortage of trained urologists in many parts of Sub-Saharan Africa, the majority of radical cystectomy procedures are performed by general surgeons rather than specialized urologists [48]. This lack of specialized expertise often impacts surgical outcomes, complication rates, and long-term patient prognosis. Expanding access to urologic oncology services in the region will require significant investment in surgical training, improvements to healthcare infrastructure, and the establishment of additional specialized centres to address the growing gap in bladder cancer care.

Impact of comorbidities on surgical outcomes in Sub-Saharan Africa

Bladder cancer management in Sub-Saharan Africa is significantly complicated by the high prevalence of comorbidities such as hypertension, diabetes mellitus, and HIV/AIDS. These conditions contribute to increased perioperative morbidity and mortality following radical cystectomy, exacerbating already poor oncological outcomes due to late-stage disease presentation. Studies from the region have demonstrated that patients with uncontrolled hypertension and diabetes undergoing major oncologic surgeries face higher rates of postoperative infections, delayed wound healing, and prolonged hospital stays [49].

Immunosuppression associated with HIV/AIDS further increases susceptibility to surgical-site infections and sepsis, leading to prolonged recovery and higher perioperative mortality [50]. In a Tanzanian cohort study assessing perioperative complications following urologic oncological surgeries, HIV-positive patients had a significantly higher risk of wound dehiscence and urinary tract infections compared to their HIV-negative counterparts. Despite the availability of antiretroviral therapy (ART), perioperative care remains inadequate, with many facilities lacking preoperative screening protocols for viral load suppression, further increasing the risk of postoperative complications [51].

Preoperative optimization strategies, such as stringent glycemic control, aggressive antihypertensive therapy, and ART adherence programs, have demonstrated benefits in mitigating surgical complications [52]. However, access to specialized perioperative care remains limited in many parts of the region, with studies reporting that less than 30% of bladder cancer patients undergoing RC receive adequate preoperative risk stratification [46]. Given these systemic constraints, an urgent priority for healthcare policymakers is the integration of structured comorbidity management into bladder cancer treatment pathways. Strengthening perioperative protocols, expanding access to routine metabolic and infectious disease screening, and implementing cost-effective prehabilitation programs will be essential to improving surgical outcomes in resource-limited settings [53].

Role of neoadjuvant and adjuvant therapies

Neoadjuvant and adjuvant therapies are essential in the treatment of muscle-invasive bladder cancer (MIBC). Neoadjuvant chemotherapy, particularly cisplatin-based regimens, improves survival by downstaging tumors and reducing micrometastatic disease, while adjuvant chemotherapy lowers the risk of recurrence post-cystectomy [40, 54]. Studies have shown a 5% survival benefit at five years with neoadjuvant chemotherapy [41, 55].

However, access to these therapies is limited in many Sub-Saharan African countries due to financial and infrastructural barriers [50]. The availability of cisplatin-based chemotherapy is particularly restricted, and patients often present with renal impairment and malnutrition, complicating treatment [38]. In resource-limited settings, improving surgical techniques and enhancing postoperative care are crucial in mitigating the lack of access to chemotherapy.

Expanding access to chemotherapy and radiotherapy is essential for improving outcomes, requiring investment in oncology infrastructure, policy reform, and multidisciplinary care [56]. Until systemic therapies are more accessible, optimizing surgical management remains key in improving survival outcomes for bladder cancer patients in Sub-Saharan Africa.

Disparities in radiation and chemotherapy access

Access to chemotherapy and radiation therapy is severely limited in much of Sub-Saharan Africa [53]. Many

hospitals lack the necessary infrastructure to provide systemic chemotherapy, and radiation therapy is often either unavailable or prohibitively expensive. As a result, patients undergoing radical cystectomy (RC) in Africa face poorer survival outcomes compared to their counterparts in high-income countries [57]. This disparity is particularly evident in patients with urothelial carcinoma (UC), as squamous cell carcinoma (SCC) is generally treated with radical cystectomy. Expanding access to these critical adjunctive therapies is essential for improving survival rates and reducing the disease burden across the region.

Patient selection criteria in Resource-Limited settings

In Sub-Saharan Africa, patient selection for radical cystectomy is largely determined by disease stage at presentation, access to diagnostic facilities, and the availability of skilled surgical teams [53]. Early detection of bladder cancer is often delayed, as screening programs are limited or absent in many regions. Consequently, a significant number of patients present with advanced-stage disease. Additionally, access to preoperative assessments, including imaging studies and laboratory tests, is restricted, making comprehensive evaluations challenging [28]. As a result, decisions to proceed with radical cystectomy are based on clinical judgment, factoring in cancer stage, the patient's overall health, and the feasibility of a successful surgical outcome. Given these constraints, surgical teams prioritize patients who have a reasonable prognosis, can tolerate major surgery, and stand to benefit from the survival advantages associated with radical cystectomy [58].

Psychosocial and cultural factors affecting patient outcomes

Psychosocial and cultural factors significantly influence patient outcomes following radical cystectomy in Sub-Saharan Africa. Cultural perceptions of cancer, alongside social stigma, can affect a patient's decision to seek medical care and adhere to treatment regimens [10]. The psychological burden of undergoing major surgery, including urinary diversion, often impacts quality of life [59, 60]. In many cases, patients face additional challenges due to lack of family support after surgery. Many cancer patients are segregated by their loved ones, who may view them as burdens due to the perceived loss of productivity and income [61]. This lack of support further exacerbates the emotional and psychological strain, impacting both recovery and long-term survival. Counselling services, along with social support systems, are critical to improving patient outcomes and fostering resilience during recovery [10, 20].

Gender differences in outcomes after radical cystectomy

Outcomes after radical cystectomy (RC) for bladder cancer show notable gender differences, influenced by biological factors, disease characteristics, and post-surgical complications. Men typically have better survival rates than women, despite similar disease stages at diagnosis, possibly due to the effects of testosterone [62]. Women, however, often present with more advanced disease, and bladder cancer in women is more likely to be associated with aggressive histological types like squamous cell carcinoma (SCC), particularly in regions with high schistosomiasis prevalence [63, 64]. Post-surgical complications also differ, with women experiencing higher rates of stomal complications and urinary tract infections. Men tend to face sexual dysfunction related to prostate involvement, while women encounter more significant challenges, including sexual dysfunction and lower urinary tract symptoms that affect their quality of life [22]. Additionally, men are more likely to receive continent diversions (e.g., neobladders or Indiana pouches), while women often undergo cutaneous diversions or ileal conduits due to anatomical constraints. These differences highlight the need for gender-tailored approaches to treatment, considering both medical and psychosocial factors [25, 32].

Regional variations within Sub-Saharan Africa

There are significant regional variations in the management of bladder cancer and radical cystectomy outcomes across Sub-Saharan Africa [53]. These disparities are influenced by differences in healthcare infrastructure, access to surgical care, and the prevalence of risk factors such as schistosomiasis [2]. In urban areas, where healthcare facilities are more developed, access to radical cystectomy is generally better, but in rural areas, patients often face delays in diagnosis and limited access to surgical care. Furthermore, regional differences in health policies and resource allocation impact the availability of both diagnostic services and treatment options [18]. Addressing these regional disparities is critical for improving access to radical cystectomy and optimizing survival outcomes for patients with bladder cancer across Sub-Saharan Africa [6]. (Table 4)

Health system challenges and innovations

Sub-Saharan Africa faces systemic challenges in delivering high-quality RC care, including shortages of trained surgeons, inadequate infrastructure, and limited access to advanced technologies like robotic-assisted surgery [53, 65]. Innovations such as telemedicine, task-shifting to train mid-level healthcare providers, and mobile surgical units are being explored to bridge these gaps [66]. Accurate data collection remains a major barrier to understanding bladder cancer outcomes in Africa.

Cancer registries are incomplete or non-existent in many regions, making it difficult to track long-term patient outcomes or conduct robust epidemiological studies [29]. The establishment of centralized cancer databases and improved follow-up systems will be crucial for future research and healthcare planning.

Long-Term Cancer survivor outcomes after radical cystectomy

Long-term follow-up after radical cystectomy is crucial for detecting recurrence, managing complications, and improving the overall survival and quality of life in bladder cancer survivors [51]. However, in Sub-Saharan Africa, logistical and financial barriers such as limited healthcare access, transportation challenges, and the high cost of regular medical visits often impede effective post-surgical care, leading to suboptimal outcomes [52, 53].

Survival outcomes after radical cystectomy can vary significantly based on factors such as tumor stage, lymph node involvement, and regional healthcare infrastructure. Some studies report 5-year overall survival rate of 25–40% after radical cystectomy in Africa, although data remains sparse [50]. The scarcity of region-specific research highlights the need for better tracking and reporting of cancer survivor outcomes to accurately estimate the cancer burden and mortality in Sub-Saharan Africa [67].

Cancer survivor outcomes are not consistently tracked in many parts of Sub-Saharan Africa, representing a significant gap in understanding the burden of cancer in the region [51]. However, studies in countries like Somalia emphasize that structured follow-up, even with limited resources, can improve survival outcomes [67, 68]. Additionally, retrospective reviews from other Sub-Saharan African nations underline the positive impact of regular follow-up in detecting recurrences early and managing complications effectively [68].

To improve these outcomes, affordable, accessible follow-up programs tailored to local needs are essential. Addressing healthcare access, transportation issues, and patient education on the importance of regular visits are crucial strategies to enhance cancer survivorship. Overcoming these barriers will help Sub-Saharan Africa better estimate its cancer burden, improve post-operative care, and ultimately improve long-term survival for bladder cancer patients [50].

Oncological and functional outcomes

The primary objectives of radical cystectomy (RC) are to achieve oncologic control and preserve functional outcomes. However, in Sub-Saharan Africa, robust data on key oncologic endpoints such as recurrence-free survival (RFS) and overall survival (OS) remain limited due to significant disparities in healthcare infrastructure, fragmented follow-up systems, and inconsistent cancer registries. The paucity of long-term outcome data presents a major challenge in assessing the true burden of bladder cancer and the effectiveness of surgical interventions in the region [28].

In high-income countries, 5-year OS rates for patients with localized muscle-invasive bladder cancer following RC range from 50 to 65% [35]. However, in Africa, these survival outcomes are likely to be considerably lower, driven by delayed diagnoses, advanced-stage presentation, and restricted access to multimodal therapy, including neoadjuvant chemotherapy and adjuvant treatments. A study from East Africa reported that over 70% of patients presented with locally advanced disease at the time of diagnosis, with a significant proportion deemed inoperable due to late-stage progression [7, 14]. Functional outcomes following RC, including urinary continence, sexual function, and overall quality of life, are often underreported in the African context. Limited access to continent urinary diversions, coupled with a lack of postoperative rehabilitation programs, results in a high prevalence of long-term morbidity. Studies from tertiary centres in Africa have shown that the ileal conduit remains the predominant form of urinary diversion due to its relative simplicity and lower perioperative morbidity; however, it is associated with significant psychosocial distress and quality-of-life limitations [53]. Furthermore, differences in treatment and outcomes between SCC and urothelial carcinoma have been expanded upon in this revision, noting the aggressive nature of SCC and its frequent association with schistosomiasis and impact of comorbidities on surgical outcomes Table 2.

Table 2 Impact of Comorbidities on Surgical Outcomes. A table summarizing common comorbidities and their impact on surgical outcomes for patients undergoing radical cystectomy in sub-Saharan Africa

Comorbidity	Impact on Surgical Outcomes	Frequency in Sub-Saharan Africa
Diabetes Mellitus	Increased risk of infections and delayed healing	High frequency
Hypertension	Increased surgical risk, potential for bleeding	Moderate to high frequency
Cardiovascular Disease	Increased anesthesia risk and post-op recovery time	Low to moderate frequency
HIV/AIDS	Potential for immunocompromised recovery	High frequency

Table 3 Summarizing the centers that offer specialized urologic surgical services, including radical cystectomy, in sub-Saharan Africa

Country	Hospital/Centre	Specialization
Tanzania	• Muhimbili National Hospital • Bugando medical centre • Kilimanjaro christian medical centre, • Rabininsia Memorial Hospital • Mbeya Zonal Referral Hospital.	Largest referral hospital offering specialized urologic surgery
Kenya	• Kenyatta National Hospital • Aga Khan University Hospital (Nairobi), • HCG CCK Cancer Centre • 3rd Park Hospital • Thika Level 5 Hospital • The Nairobi Hospital • Moi Teaching and Referral Hospital (MTRH	Largest referral hospital in East Africa with urologic oncology
Uganda	• Mulago National Referral Hospital • Mengo Hospital • Kisiizi Hospital	
Zambia	• University Teaching Hospital (UTH) (Lusaka) • Livingstone General Hospital (Livingstone) • Ndola Teaching Hospital (Ndola) • Mansa General Hospital (Mansa) • Medland Hospital (Lusaka) • Zambia Cancer Diseases Hospital (CDH) (Lusaka)	Premier institution for urologic cancer treatment
Rwanda	• Kigali University Teaching Hospital • Ruhengeri Referral Hospital (Musanze) • Butare Referral Hospital (Huye)	
South Africa	• Groote Schuur Hospital, • Tygerberg Hospital, • Charlotte Maxeke Johannesburg Academic Hospital, Mediclinic Durbanville • Netcare Waterfall City Hospital • Mediclinic Panorama • Steve Biko Academic Hospital • Wits University Donald Gordon Medical Centre, Addington Hospital • Mediclinic Morningside • Life Fourways Hospital • Life Wilgers Hospital • Mediclinic City Hospital • Netcare Unitas Hospital	Leading center for urologic oncology and advanced procedures
Ghana	• Korle-Bu Teaching Hospital • Komfo Anokye Teaching Hospital • Tamale Teaching Hospital • Medical Centre of Excellence • International Maritime Hospital (Tema) • Nyaho Medical Centre (Accra) • Ghana's National Cancer Centre (Accra).	High-volume center for radical cystectomy
Nigeria	• National Hospital Abuja • Lagos University Teaching Hospital • University College Hospital (UCH) (Ibadan) • University of Nigeria Teaching Hospital (Enugu) • Ahmadu Bello University Teaching Hospital (ABUTH) • Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC) • St. Nicholas Hospital, • The First Consultant Medical Centre • Eko Hospital (Lagos) • Lagos State University Teaching Hospital (Lagos), • Babcock University Teaching Hospital	Tertiary referral center with specialized oncology services
Malawi	• Zomba Central Hospital (ZCH) • Kamuzu Central Hospital (KCH)	These hospitals are equipped to perform complex urological surgeries, including radical cystectomy.

Table 3 (continued)

Country	Hospital/Centre	Specialization
Zimbambwe	• Parirenyatwa Group of Hospitals (Harare) • Harare Central Hospital (Harare) • Bulawayo Central Hospital (Bulawayo) • St. Annes Hospital (Harare) • Mater Dei Hospital (Bulawayo)	These hospitals are equipped to perform complex urological surgeries, including radical cystectomy
Namibia	• Windhoek Central Hospital (Windhoek) • Rundu State Hospital (Rundu)	These hospitals are equipped to perform complex urological surgeries, including radical cystectomy
Botswana	• Princess Marina Hospital (Gaborone)	The leading centre for advanced urological surgeries
Congo	• Hôpital Général de Référence de Kinshasa	This centre perform RC
Mozambique	• Hospital Central de Maputo (Maputo)	This centre perform RC
Ethiopia	• Tikur Anbessa Specialized Hospital (Addis Ababa) • St. Paul's Hospital Millennium Medical College (Addis Ababa) • Gandhi Memorial Hospital (Addis Ababa)	These hospitals are equipped to perform complex urological surgeries, including radical cystectomy
Liberia	**Liberia**, **John F. Kennedy Medical Center (JFKMC)** is the primary public hospital offering urological services, but complex surgeries like radical cystectomy are generally referred abroad, particularly to Ghana, Nigeria, or South Africa, where the necessary surgical expertise and facilities are available.	
Madagascar	**Centre Hospitalier Universitaire (CHU) Antananarivo** (For complex surgeries like radical cystectomy, CHU Antananarivo may refer patients to specialized centres abroad, particularly in South Africa)	
sudan	Given that **Sudan** lacks the specialized capacity for **radical cystectomy**, patients requiring this surgery are often referred to other countries in **Africa** or the **Middle East**.	
Benin	Patients requiring such complex surgeries are often referred to specialized centers abroad, particularly in **France**, **South Africa**, or other countries with more advanced medical facilities.	
senegal	Centre Hospitalier Universitaire de Fann (CHU de Fann)	
Sierra leone	In **Sierra Leone**, the healthcare system is still developing, and while there are hospitals offering basic urological and oncology services, advanced procedures like **radical cystectomy** are often unavailable locally.	
Ivory cost	• Centre Hospitalier Universitaire de Treichville (Abidjan) • Hôpital d'Instruction des Armées (HIA) (Abidjan)	These hospitals are equipped to perform complex urological surgeries, including radical cystectomy
Burundi	In **Burundi**, the healthcare system is still developing, and while there are some hospitals providing basic urological care and oncology services, advanced surgeries like **radical cystectomy** may not be readily available. For complex urological surgeries, patients may be referred to neighboring countries with more advanced medical facilities.	
Somalia	In **Somalia**, the healthcare system is still developing and may not offer advanced treatments like **radical cystectomy** due to limited resources and infrastructure.	
Burkina Faso	Patients are always referred to Ghana or Ivory coast	
Mauritania	Advanced surgeries like **radical cystectomy** may not be widely available.	
Seychelles	Patients in Seychelles who require **radical cystectomy** or other advanced treatments for bladder cancer are often referred to specialized hospitals in neighboring countries with more advanced medical facilities.	
Mauritius	• Dr. A.G. Jeetoo Hospital (Port Louis) • Apollo Bramwell • Wellkin Hospital (Moka)	Centres which perform advanced urological surgeries such as radical cyctectomies.

Table 3 (continued)

Country	Hospital/Centre	Specialization
Mali	While **Mali** has hospitals like **CHU Point G** and **Gabriel Touré Hospital** that provide medical and surgical care, **radical cystectomy** and other advanced urological surgeries are unlikely to be performed locally due to limitations in specialized facilities	
Gabon	In **Gabon**, **CHU Libreville** and **HIA Omar Bongo Ondimba** are the major public hospitals, while private clinics like **Clinique El Djor** and **Clinique du Serment** offer general medical services. However, **radical cystectomy** and other highly specialized surgeries are likely unavailable locally due to limited resources	

N.B The information provided in these tables has been carefully extracted from the official websites of hospitals and government health portfolios. These reliable sources offer insights into the healthcare services available in various countries, including specialized surgeries such as **radical cystectomy**. However, due to the lack of a comprehensive urological hospital database across Africa, some of the information could not be fully verified

Table 4 Regional Variations in Radical Cystectomy Practices in Africa. A table comparing the practices, resources, and outcomes of radical cystectomy across different regions in Sub-Saharan Africa

Region	Technique Availability	Survival Rates	Complication Rates	Resource Availability
East Africa (e.g., Tanzania, Kenya)	Open radical cystectomy, limited laparoscopic options	Moderate	Moderate	Limited advanced surgical resources
West Africa (e.g., Nigeria)	Mixed availability of techniques	Low to moderate	High	Limited access to robotics and laparoscopy
Southern Africa (e.g., South Africa)	Laparoscopic and robotic cystectomy widely available	High	Low to moderate	Better resources for advanced surgical care

Conclusion

Improving outcomes for radical cystectomy (RC) in Sub-Saharan Africa requires a multifaceted approach that prioritizes surgical training, infrastructure development, and equitable access to multimodal cancer care. Strengthening early detection strategies, expanding perioperative support, and optimizing cost-effective urinary diversion techniques are critical steps in addressing current challenges. Additionally, collaborative research and data-driven policies will be essential in shaping future interventions. By integrating these efforts, healthcare systems can enhance surgical quality, reduce disparities, and improve survival for bladder cancer patients in the region.

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Author contributions
The principal author (CN) prepared the initial draft of the manuscript, and all other authors reviewed the manuscript and contributed their expert opinions. CN took full responsibility for the integrity of the manuscript and ensured the accuracy of the information presented. • Concept and Design: CN, CM, ON. • Drafting of the Manuscript: CN, CM, ON. • Critical Revision of the Manuscript for Intellectual Content: CM, ON. • Supervision: CM & ON. All authors reviewed and approved the final draft of the manuscript for publication.

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Declarations

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