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Analyzing the emergence of surgical robotics in Africa: a scoping review of pioneering procedures, platforms utilized, and outcome meta-analysis

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Purpose: Surgical practice globally has undergone significant advancements with the advent of robotic systems. In Africa, a similar trend is emerging with the introduction of robots into various surgical specialties in certain countries. The need to review the robotic procedures performed, platforms utilized, and analyze outcomes such as conversion, morbidity, and mortality associated with robotic surgery in Africa, necessitated this study. This is the first study examining the status and outcomes of robotic surgery in Africa.

Methods: A thorough scoping search was performed in PubMed, Google Scholar, Web of Science, and African Journals Online. Of the 1,266 studies identified, 16 studies across 3 countries met the inclusion criteria. A meta-analysis conducted using R statistical software estimated the pooled prevalences with the 95% confidence interval (CI) of conversion, morbidity, and mortality.

Results: Surgical robots are reportedly in use in South Africa, Egypt, and Tunisia. Across four specialties, 1,328 procedures were performed using da Vinci (Intuitive Surgical), Versius (CMR Surgical), and Senhance (Asensus Surgical) surgical robotic platforms. Urological procedures (90.1%) were the major procedures performed, with robotic prostatectomy (49.3%) being the most common procedure. The pooled rate of conversion and prevalence of morbidity from the meta-analysis was 0.21% (95% CI, 0%–0.54%) and 21.15% (95% CI, 7.45%–34.85%), respectively. There was no reported case of mortality.

Conclusion: The outcomes highlight successful implementation and the potential for wider adoption. Based on our findings, we advocate for multidisciplinary and multinational collaboration, investment in surgical training programs, and policy initiatives aimed at addressing barriers to the widespread adoption of robotic surgery in Africa.

Keywords: Robotic surgical procedures, Minimally invasive surgical procedures, Africa

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INTRODUCTION

From conventional open surgery to the advent of cutting-edge robotic systems, the trajectory of surgical innovation is quite intriguing and complex [1]. In recent decades, minimal access surgical practice has undergone a transformative evolution, with technological advancements leading to the development and adoption of robotic systems [2]. Robotic surgery has emerged as a paradigm-shifting approach, offering surgeons enhanced precision, reduced fatigue, improved visualization, and improved patient care and outcomes [3,4].

The application of robots in surgery began in the late 1980s, with the use of the PUMA 560 (Unimation) for a neurological procedure [5]. Several surgical robots including da Vinci (Intuitive Surgical), Senhance (Asensus Surgical), and Versius (CMR Surgical) have since then gained wide application in various surgical specialties globally [6,7], especially in the United States where about 70% of all Intuitive Surgical robotic procedures are presently performed [8]. The same trend is emerging in Africa with certain countries reporting the adoption of these surgical robots for use in different surgical specialties [9,10].

The da Vinci system, developed in the United States in 1995 [11], is renowned for its precision in urological, gynecological, general surgical, and otolaryngological procedures [6,7,12], while the Senhance system, first used for a hysterectomy procedure in Rome [13], offers unique haptic feedback capabilities [6], and the Versius is a more recent ergonomic and collaborative platform indicated for use in adult general surgery, gynecology, urology, and cardiac surgery [6,7,12]. Other robotic systems, including Kangduo (Suzhou Kangduo Robot), Hinotori (Medicaroid), MicroHand (Tianjin University and WEGO), Revo-I (MeereCompany), Toumai (Shanghai MicroPort MedBot), MP1000 and SP1000 (Shenzhen Edge Medical Records), SSi Mantra (SS Innovations), Shurui (Shurui Robotics), and Carina (Ronovo Surgical), were developed and are in use in Asia [6,7,14]. Hugo (Medtronic), Avatera (AvateraMedical GmbH), and Dexter (Distalmotion) are other robotic systems in use in European and American settings [6,15]. Emerging surgical robots include Enos (Titan Medical), MIRA (Virtual Incision), MiroSurge (DLR), Vicarious (Vicarious Surgical), Bitrack (Rob Surgical), and Ottava (Medtronic) [6,7]. Micro-robots, single-port robotic surgery, and nanorobots are emerging frontiers in surgical robotics [3]. While the da Vinci platform by Intuitive Surgical has long been the dominant robotic system globally [11], new and cheaper platforms bring the potential of improved utilization in resource-constrained environments such as Africa [16].

Robotic surgery has no doubt proven to be a game-changer globally, promising benefits such as increased surgical precision, reduced invasiveness, and faster patient recovery [17,18]. However, in a World Health Organization report of 2023, approximately 60% of hospitals in Sub-Saharan Africa face regular power outages, while 15% of facilities lack any access to electricity, significantly impacting the feasibility of adopting advanced surgical technologies like robotic systems [19]. The adoption of robotic surgery in Africa thus presents a nuanced picture, one interwoven with the continent's unique healthcare challenges and socioeconomic realities [18–20].

This study was prompted by the necessity to evaluate the current status of robotic surgery in Africa, including outlining the robotic procedures performed across the continent and analyzing outcomes such as the conversion rate to open surgery, as well as the associated morbidity and mortality.

METHODS

A single-blind scoping literature review was conducted in December 2023 in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) [21]. This study was registered in the Open Science Framework registries (doi.org/10.17605/OSF.IO/UDYZW).

Search strategy

The literature search was performed in four databases. PubMed, Google Scholar, and Web of Science, due to their extensive coverage of biomedical literature. In addition, African Journals Online was searched because of its peculiar representation of African healthcare research. The search was conducted by three independent reviewers between December 6, 2023 and January 13, 2024 using these keywords in combination with Boolean operators: ('Robotic' OR 'Robot-assisted' OR 'Robot') AND ('Surgery' OR 'Procedure') AND ('Africa' OR 'Country names'). Truncation and synonyms were employed to account for variations in terminology and ensure comprehensive coverage of relevant literature. The full strategy can be seen in Appendix.

Search results were uploaded to Rayyan [22] for deduplication and screening, using the set-out inclusion and exclusion criteria. Discrepancies or disagreements among reviewers during the screening and data extraction phases were resolved through consensus meetings. In cases where consensus could not be reached, a third reviewer was consulted to arbitrate and make the final decision regarding study inclusion.

We recognize the potential for language bias in our review. To mitigate language bias, we attempted to identify relevant non-English articles through translation of the search keywords to French, Arabic, and Portuguese, the three major non-English official languages in Africa. Non-English articles were translated to English using Google Translate, for screening and data extraction.

Eligibility for inclusion

Studies deemed eligible for inclusion had to meet the following PICOS criteria [23].

- P (Population): Patients who had robotic procedures in Africa
- I (Intervention): Robotic procedures
- C (Comparators): Different robotic procedures performed, countries where they were performed, and robotic systems used
- O (Outcomes): Full recovery, morbidity or mortality
- S (Study design): Editorial, case report, prospective, retrospective, and cross-sectional studies

Inclusion criteria

Studies that report the use of robotic systems for surgical procedures performed in Africa.

Exclusion criteria

Studies not carried out in Africa and those that do not include procedures done and the outcomes. Editorials, case reports. Studies with less than 10 participants (n ≤ 10) were excluded from the meta-analysis.

Data extraction

Data extracted from selected studies include the title of the paper, lead author, author's affiliation, year of publication, period of study, study design, country of study, total sample size, age range, mean age, presenting symptoms, robotic procedures performed, robotic surgery system used, surgical techniques, operative data, mean robotic time, mean total operative time, estimated blood loss, mean hospital stay, technical difficulties, conversion to open surgery, morbidity, and mortality.

Meta-analysis

A meta-analysis was carried out in R statistical software version 4.4.1 (R Foundation for Statistical Computing) and R Studio version 2024.04.2+764, using "meta" and "metafor" packages. The pooled prevalences with the 95% confidence interval (CI) of conversion of robotic procedures to open surgery, morbidity, and mortality were obtained. Only cohort reports with a sample size (n ≥ 10) were included in the meta-analysis. Heterogeneity between studies was tested by the I^2 test. A random-effects model was used when $I^2 > 50\%$ (high risk of heterogeneity) and a fixed-effects model was used when $I^2 \leq 50\%$ (low risk of heterogeneity).

Assessment of methodologic quality and risk of bias

Risk of bias was assessed using The Cochrane tool, Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) [24,25]. Risk-of-bias plots were then visually generated using the ROBVIS (Risk-of-Bias Visualization) tool [26]. Each included publication was assigned a risk-of-bias category as follows: low risk, which is similar to a well-executed randomized controlled trial in terms of this specific bias domain; moderate risk, which represents a well-conducted nonrandomized study within this domain but does not fully meet the standards of a high-quality randomized trial; serious risk, indicating important limitations within this domain; critical risk, highlighting severe issues that render the study unable to provide reliable evidence on the intervention's effects; and no information, indicating insufficient information to make a judgment about the risk of bias within this domain [25]. Three included studies which were not studies of interventions (editorial and cross-sectional studies) were not assessed.

RESULTS

Flow of studies

The scoping search performed across four databases returned 1,266 articles, 402 of which were excluded as duplicates. One report was identified from the official website of the Middle East and Mediterranean Association of Gynaecologic Oncologists. Of the remaining 864 studies, we excluded 588 at the title and abstract screening level because they did not meet the inclusion criteria, and subjected the remaining 276 articles to full text screening. In total, 16 studies were ultimately included in this study, after exclusion of 260 articles due to various reasons as shown in the PRISMA flow diagram (Fig. 1).

Study characteristics

The included studies were published between 2003 and 2023. The majority were published between 2020 and 2024 (Fig. 2). Out of these studies, two (12.5%) were editorials, three (18.8%)

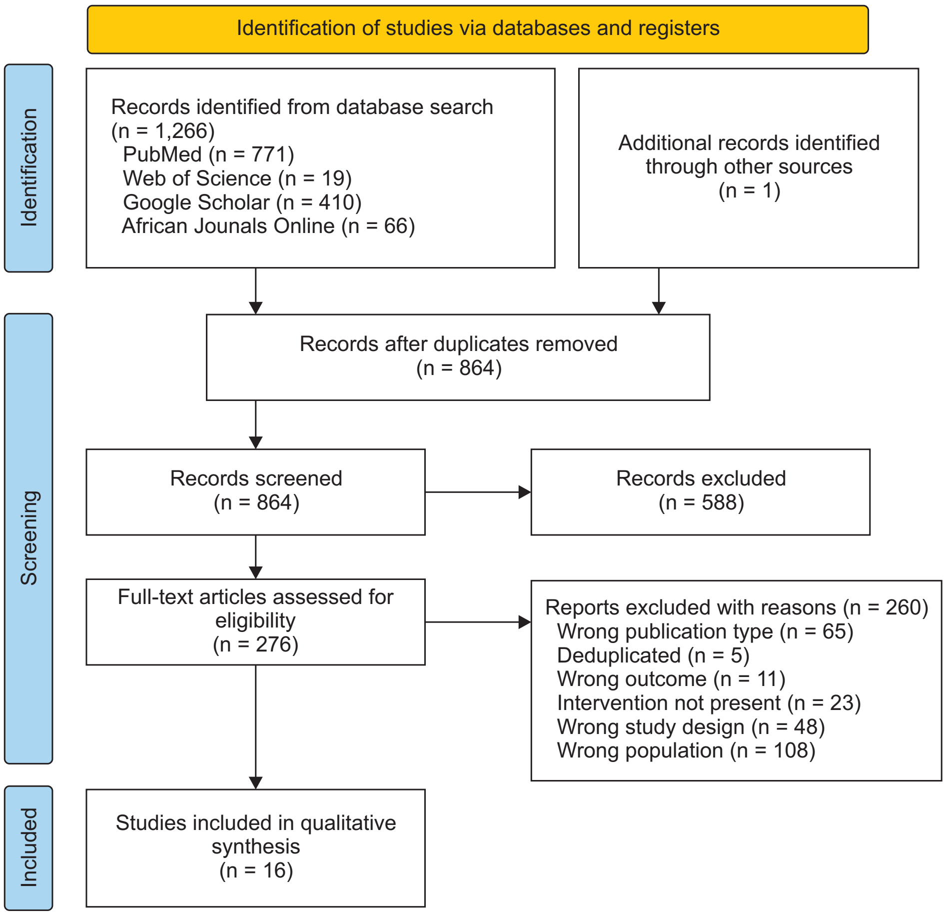

Fig. 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 flow diagram for new systematic reviews which included searches of databases and registers only.

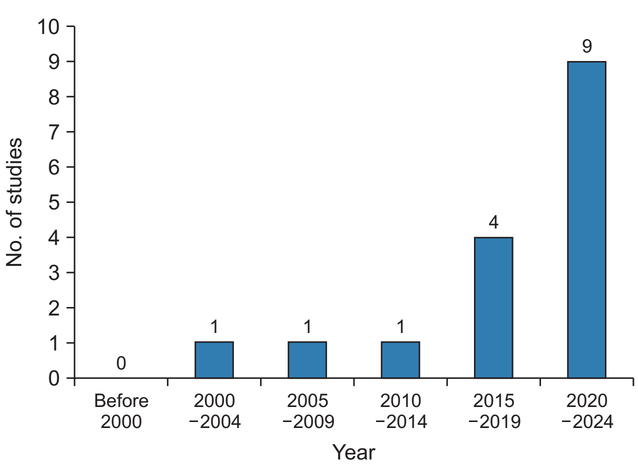

Fig. 2. Number of studies per year of publication.

were case reports, one (6.3%) was a cross-sectional study, 5 (31.25) were retrospective cohorts, four (25.0%) were prospective cohorts, and one (6.3%) was a prospective randomized controlled trial. The included studies were published across three African countries: Egypt, South Africa, and Tunisia while 51 African countries (94.4%) have not reported the use of surgical robots.

Most of the studies, specifically 12 (75%), were published in Egypt. South Africa contributed three studies (18.8%), while one (6.3%) was from Tunisia. The majority of procedures, 1,101 (82.9%) were performed in South Africa, followed by 216 (16.3%) performed in Egypt, and 11 (0.8%) in Tunisia. Fig. 3 illustrates the distribution of procedures and reports across different countries.

A total of three robotic platforms were used across the 16 studies. The robotic platforms used were reported in 13 studies. Among these, the da Vinci surgical system was utilized in the majority, comprising 11 studies (68.8%), while the Versius and Senhance surgical robotic systems were each used in one study (6.3%). The robotic platforms used in three studies (18.8%) were not reported. The total sample size across the 16 studies is 1,328. The study characteristics are presented in Table 1 [9,10,27–40].

Fig. 3. Distribution of robotic procedures and number of reports per country.

Robotic procedures performed

Our study shows that robotic surgery has been adopted across four surgical specialties in Africa: cardiothoracic, general, gynecological, and urological surgery. A total of 1,328 procedures were performed. Urological procedures performed in 1,196 cases (90.1%) across six studies were the predominant robotic procedures performed in Africa. This is followed by general surgical procedures, performed in 98 patients (7.4%). Prostatectomy, performed in 655 patients (49.3%) is the most common procedure performed. Table 2 displays the number of reports, percentage of reports, sample sizes, percentage of sample sizes, and procedures performed in each specialty. The percentage of reports per specialty is depicted in Fig. 4.

Conversion to open surgery

Six cases of conversion of robotic to open surgery were identified. There were no procedures converted to laparoscopy. The first was a case of robot-assisted rectal surgery converted to open surgery as a result of a bulky mid-rectal tumor in a very narrow male pelvis. Another was a case of robotic radical prostatectomy which was converted due to difficulty with the urethrovesical anastomosis. Also, a case of robotic colorectal surgery was converted due to a locally advanced tumor. Reasons for conversion in three cases were not reported.

Meta-analysis

Eight cohort studies with sample size (n ≥ 10) which reported the rate of conversion among their study population were included in the meta-analysis of conversion of robotic to open surgery. Zero events were observed in three studies [9,32,36]. To improve feasibility and validity of the analysis [41], continuity correction of one was added to zero events. Common effects model was used since I^2 was less than 50% (low risk of heterogeneity). The meta-analysis revealed a pooled conversion rate of 0.2% (95% CI, 0%–0.5%; eight studies and 775 participants) (Fig. 5).

Morbidity and mortality

A total of 56 complications were recorded in 49 patients following various robotic procedures (Table 3). Prolonged postoperative ileus which occurred following robotic resection of rectal carcinoma, urine leak, and Intraoperative hemorrhage requiring blood transfusion were the major complications. Urine leakage occurred in eight cases of radical prostatectomy and was managed with exploration and percutaneous nephrostomy in two cases. There was no recorded case of mortality.

Meta-analysis

Eight cohort studies with sample size (n ≥ 10) reported the complications among their study population and were included

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Table 1. Study characteristics

Study	Country	Study design	Publication year	Sample size	Robotic surgery system used	Procedure(s) performed
De Jager et al. [9]	South Africa	Retrospective cohort	2021	600	Not reported	Robot-assisted laparoscopic radical prostatectomy
Zaghloul et al. [10]	Egypt	Retrospective cohort	2021	55	da Vinci	Robotic radical prostatectomy
Debakey et al. [27]	Egypt	Prospective randomized control trial	2018	21	da Vinci	Robot-assisted rectal surgery
Abbas et al. [28]	Egypt	Retrospective cohort	2012	25	da Vinci	Robot-assisted cystoprostatectomy with urinary diversion
Abd-erRazik et al. [29]	Egypt	Case study	2022	2	Not reported	Robotic-assisted transgastric cystogastrostomy and pancreatic debridement
Forgan and Lazarus [30]	South Africa	Editorial	2023	500	da Vinci	Robot-assisted laparoscopic partial nephrectomy and pyeloplasty
Shokralla and Fathalla [31]	Egypt	Prospective cohort	2021	2	Not reported	Robotic hysterectomy
Zaghloul et al. [32]	Egypt	Prospective cohort	2018	20	da Vinci	Robotic radical hysterectomy
Van der Merwe et al. [33]	South Africa	Editorial	2022	1	da Vinci	Robotic-assisted Mc Keown esophagectomy and thoracic outlet decompression surgery
Zaghloul and Mahmoud [34]	Egypt	Prospective cohort	2016	10	da Vinci	Robotic colorectal surgery
El-Tabey and Shoma [35]	Egypt	Case study	2005	1	da Vinci	Robot-assisted laparoscopic radical cystectomy
Menon et al. [36]	Egypt	Retrospective cohort	2003	15	da Vinci	Robot-assisted radical cystoprostatectomy
Korany et al. [37]	Egypt	Cross-sectional	2023	24	da Vinci	Robotic bariatric sleeve surgery
Farag et al. [38]	Egypt	Prospective cohort	2023	40	da Vinci	Robot-assisted laparoscopic resection of mid- and low-rectal carcinoma
Maurice et al. [39]	Egypt	Case study	2023	1	Versius	Robotic-assisted Mc Keown esophagectomy
Hassouna et al. [40]	Tunisia	Retrospective cohort	2019	11	Senhance	Robotic oophorectomy, adnexectomy and hysterectomy

da Vinci, Intuitive Surgical; Versius, CMR Surgical; Senhance, Asensus Surgical.

Table 2. Robotic procedures performed per specialty

Specialty	No. of reports	Proportion of reports per specialty (%)	Sample size	Proportion of sample size per specialty (%)	Robotic procedure(s)
Urological surgery	6	37.5	1,196	90.1	Prostatectomy, cystoprostatectomy, nephrectomy, and pyeloplasty
General surgery	6	37.5	98	7.4	Colorectal surgery, cystogastrostomy, pancreatic debridement, and bariatric sleeve surgery
Gynecological surgery	3	18.8	33	2.5	Hysterectomy, oophorectomy and adnexectomy
Cardiothoracic surgery	1	6.3	1	0.1	McKeown esophagectomy and thoracic outlet decompression surgery
Total	16	100	1,328	100	

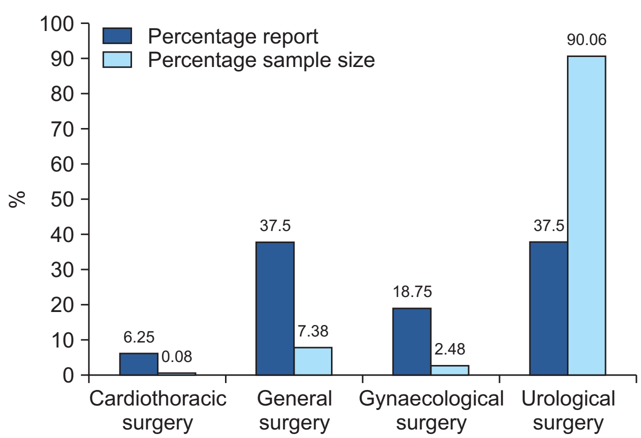

Fig. 4. Percentage report and sample size per specialty.

in the meta-analysis of prevalence of morbidity. The meta-analysis revealed a 21.2% pooled prevalence of morbidity (95% CI, 7.0%–35.0%; eight studies and 772 participants) (Fig. 6).

Methodologic quality and risk of bias

The ROBINS-I [24,25] was used to evaluate seven bias domains within each included study (Fig. 7, 8).

- Bias due to confounding (D1): low risk (four studies), moderate risk (four studies), serious risk (four studies), and no information (one study)
- Bias due to selection of participants (D2): low risk (eight studies), moderate risk (one study), serious risk (four studies)
- Bias in classification of interventions (D3): low risk (11 studies), moderate risk (two studies)
- Bias due to deviations from intended intervention (D4): low risk (six studies), moderate risk (four studies), no information (two studies)
- Bias due to missing data (D5): low risk (10 studies), moderate risk (one study), no information (two studies)
- Bias in measurement of outcomes (D6): low risk (nine studies), moderate risk (three studies), no information (one study)
- Bias in selection of reported results (D7): low risk (11 studies), moderate risk (two studies)
- Overall risk: low (three studies), moderate (four studies), and serious (six studies)

DISCUSSION

Our study has provided an important overview of the early phase of robotic surgical practice in Africa, highlighting three countries that have reported its use: Egypt, South Africa, and Tunisia. Further investigation is needed to understand the specific factors facilitating the adoption of surgical robots in these countries, particularly in Egypt and South Africa, unlike in other countries where robotic surgery is yet to be reportedly available. Possible factors may include early investment in robotic surgery training programs, favorable regulatory environments, and partnerships with industry stakeholders. In other countries, however, its adoption remains an uncertain possibility as a result of inadequate healthcare budget allocation, unreliable power supply, and most importantly, ineffective leadership [16,20].

The da Vinci, Senhance, and Versius are the three surgical robotic systems currently in use in Africa. Understandably, da Vinci, used in 11 of the included studies (68.8%), is the most used platform. It is a master-slave laparoscopic robotic platform with wide application in several surgical specialties that have been in use globally since 1998 [4]. The Senhance and Versius,

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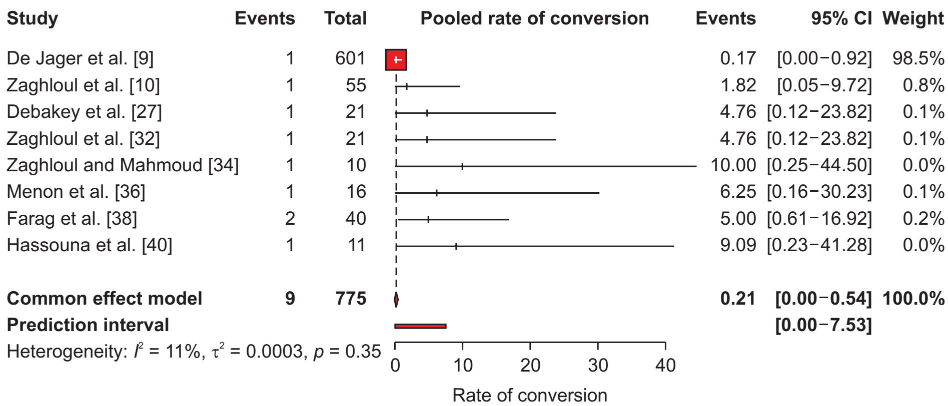

Fig. 5. Forest plot for conversion. The midpoint of each line illustrates the prevalence; the horizontal line indicates the confidence interval; and the diamond shows the pooled prevalence. CI, confidence interval.

Table 3. Complications of robotic surgery

Morbidity	No. of reports	Robotic procedure(s)
Ileus	8	Colorectal surgery
Urine leak	8	Radical prostatectomy
Intraoperative hemorrhage requiring blood transfusion	8	Radical prostatectomy (3) and radical hysterectomy (5)
Anastomotic leakage	3	Colorectal surgery
Wound infection	3	Colorectal surgery (2) and radical prostatectomy (1)
Bladder injuries	3	Radical hysterectomy
Bladder neck stenosis	3	Radical prostatectomy
Lymphocele	3	Radical prostatectomy
Chest infection	3	Radical hysterectomy
Ureteric injury	2	Radical prostatectomy
Port site hernia	2	Radical prostatectomy
Deep vein thrombosis	1	Colorectal surgery
Epigastric pain	1	Transgastric cystogastrostomy and pancreatic debridement
Vomiting	1	Transgastric cystogastrostomy and pancreatic debridement
Local recurrence of cervical cancer	1	Radical hysterectomy
Trocar site infection	1	Radical hysterectomy
Reoperation	1	Colorectal surgery
Port site metastasis	1	Radical cystectomy
Urinary tract infection	1	Radical prostatectomy
Venous thromboembolism	1	Radical prostatectomy
Small bowel obstruction	1	Radical prostatectomy

however, are newer master-slave robotic platforms that only came into light in 2017 and 2020, respectively [4,7,42]. The case report from Egypt, by Maurice et al. [39], is the first report on the use of the ergonomic Versius platform in Africa. The majority of surgical robots cost over one million US dollars [6]. The arrival of newer and cheaper robotic platforms may thus be necessary for more widespread adoption of robotic surgery in low- and middle-income settings like Africa [16].

The number of robot-assisted surgeries reported increased over the years, between 2003 and 2023. In Africa, robotic surgery is presently in use across four surgical specialties: urological, general, gynecological, and cardiothoracic surgery. In other settings, however, surgical robots have been applied in other specialties, including otolaryngology, orthopedic surgery, and

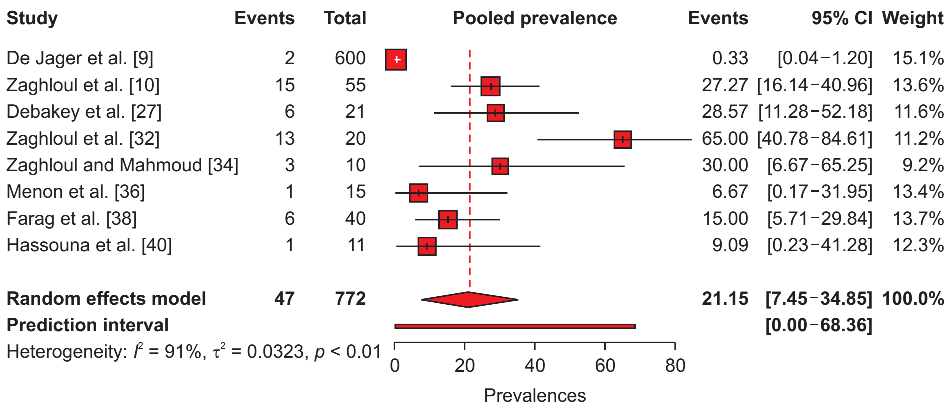

Fig. 6. Forest plot for morbidity. The midpoint of each line illustrates the prevalence; the horizontal line indicates the confidence interval; and the diamond shows the pooled prevalence. CI, confidence interval.

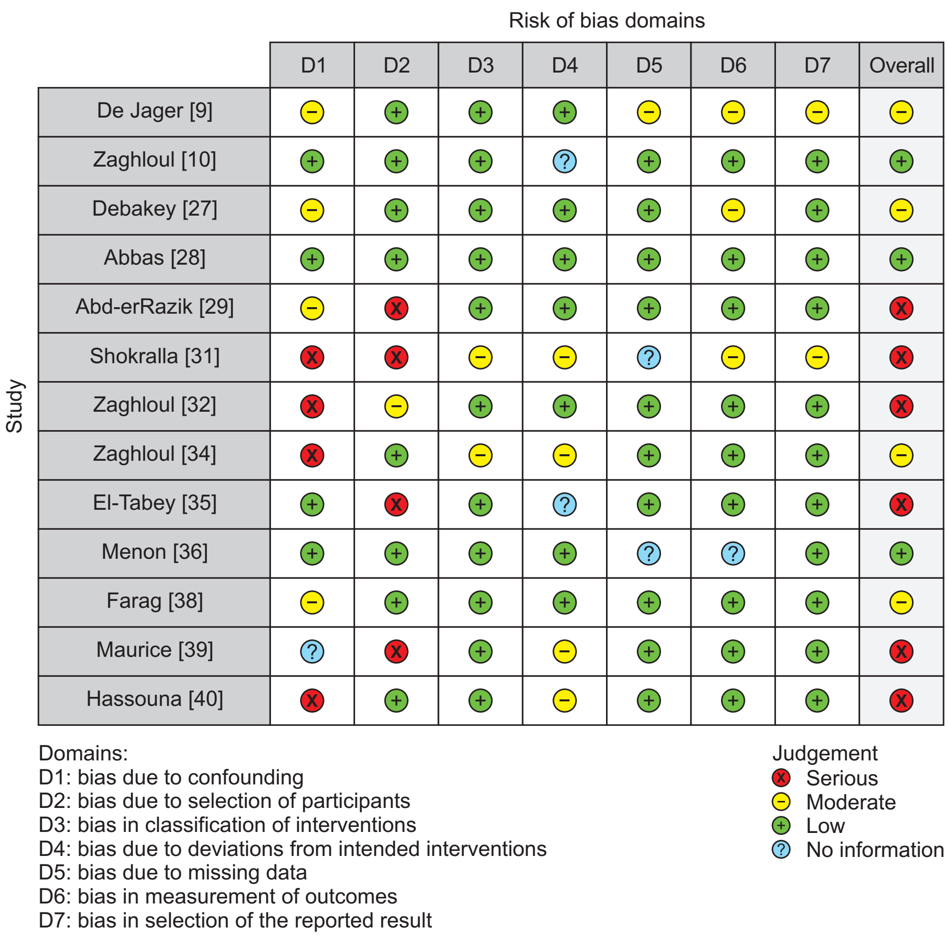

Fig. 7. Traffic light plot of risk of bias according to ROBINS-I (Risk of Bias in Non-randomized Studies of Interventions).

neurosurgery [3,43,44]. Our study shows that prostatectomy is the most commonly performed robotic procedure in Africa. This is consistent with global reports that urology has been at the forefront of adoption of the robotic approach, and that robotic prostatectomy is the most commonly performed procedure [44–46]. The differential uptake of robotic surgery across surgical specialties however underscores the need for tailored approaches to surgical training, infrastructure development, and patient access initiatives. Future research should explore how healthcare policies and resource allocation strategies can optimize the integration of robotic surgery across diverse surgical specialties.

A pooled conversion rate of 0.2% was obtained. Conversion of robotic procedures to open surgery is known to be associ-

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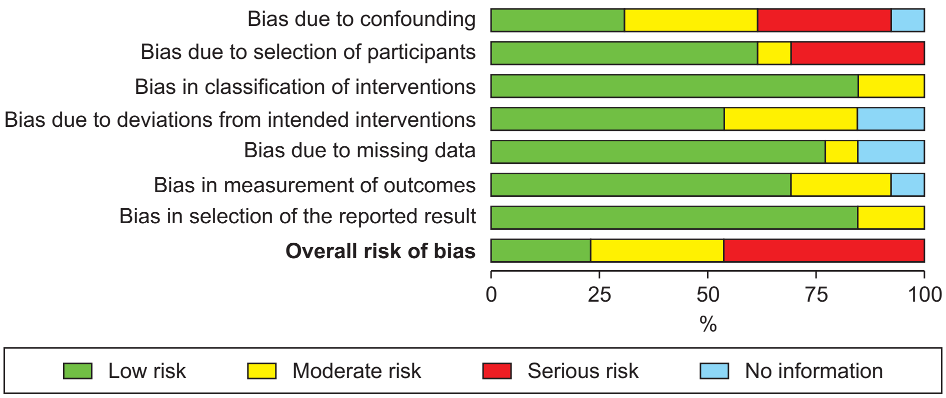

Fig. 8. Summary light plot according to ROBINS-I (Risk of Bias in Non-randomized Studies of Interventions).

ated with adverse outcomes and thus should be anticipated and planned for [47]. The conversion rate is however similarly low, compared to reports from other settings [48–50].

The pooled prevalence of morbidity is high compared to the 6% to 15% reported in studies done in Europe and the United States [48,49,51]. The morbidity rates observed vary significantly across reports. The retrospective study of 600 patients who had robotic prostatectomy in South Africa recorded only two cases of morbidity [9], while studies from other countries like Egypt recorded a significantly higher number of cases of complications [10,34]. Extensive perioperative evaluation, investigations, and an experienced robotic team are vital for reduction, early identification, and proper management of complications from robotic surgery [52].

The 0% prevalence of mortality obtained in our study is similar to the low prevalence (0%–0.4%) observed in other settings [48,51,53]. Africa has similarly recorded a low mortality rate with laparoscopy, another minimally invasive approach [54]. This suggests an even level of expert know-how with minimally invasive surgeries in Africa and other parts of the world, and the potential for wider use [54,55]. The low mortality rate associated with minimal access surgery is one of its major advantages over conventional open surgery [56]. Although our findings suggest similarities in robotic surgery outcomes between Africa and other regions, such as low mortality rates [48,51,53], it is important to recognize the unique challenges and opportunities facing African healthcare systems. Future research should explore how cultural attitudes toward technology, economic disparities, and healthcare policy frameworks influence the adoption and utilization of robotic surgery in Africa.

While our study reports no mortality associated with robotic surgery in Africa, it's important to acknowledge the variability in reported morbidity rates across studies. Factors such as differences in perioperative care protocols, surgeon experience, and patient comorbidities may contribute to variations in outcomes. Future research should focus on standardizing outcome measures and implementing quality improvement initiatives to optimize patient safety and surgical outcomes in robotic surgical practice in Africa.

Considering the fact that the gold standard of care, unlike in developed settings, is providing the best possible care within the constraints of available resources, rather than pursuing cutting-edge treatment [57], several African settings may need to solve impeding issues such as low health care system budgets, lack of a suitable training environment, inadequate power supplies, inadequate management, amongst others, before robotics can fully replace the conventional open or laparoscopic approach as gold standard [16,19]. In Africa, there is still much needed to be done before robot-assisted surgery can be adopted fully into our health system [16,58].

Based on our findings, we advocate for multidisciplinary collaboration, investment in surgical training programs, and policy initiatives aimed at addressing barriers to robotic surgery adoption in Africa. There is also a need for multicenter and national databases to keep records of the robotic surgical procedures performed in Africa. Future research should prioritize longitudinal studies to assess the long-term outcomes of robotic surgery, explore patient-centered outcomes, and evaluate the cost-effectiveness of robot-assisted procedures in diverse healthcare settings.

This study has provided the first and an important analysis of the robotic procedures performed, the robotic platforms utilized, and the outcomes of the first set of surgical patients managed with the robotic approach in Africa. The study has also provided recommendations for wider use and a foundation for future research on robotic surgery in Africa. However, the limitations include a language barrier, which might have limited the discoverability of non-English publications in the databases searched.

Additionally, some data, such as cost, estimated blood loss, and operation time, were not available or inconsistently reported in the reviewed publications, thus limiting the possibility of analysis and inclusion in this study. We recommend that future research should focus on this data to provide stronger evidence on the topic.

In conclusion, our study not only sheds light on the present state of robotic surgery in Africa but also provides a roadmap for future research, policy development, and strategic planning. By addressing the outlined challenges and implementing the suggested recommendations, Africa has the potential to bridge the gap and become an integral participant in the global landscape of robot-assisted surgery, thereby advancing surgical healthcare outcomes across the continent. Also, with the arrival of newer and cheaper robotic platforms, the promising outcomes so far signal a high likelihood of robot-assisted surgery being widely used in African healthcare management in the future.

Notes

Authors' contributions

Conceptualization, Formal analysis: AFF
Data curation: AFF, OSD, RTF, COE, MOO
Methodology: OSD, AFF, AA
Supervision, Validation: AA, AN, ODD, OSD
Writing–original draft: AFF, AA, RTF, COE, OSD
Writing–review & editing: OSD, AA, AFF, AN
All authors read and approved the final manuscript.

Conflict of interest

All authors have no conflicts of interest to declare.

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Data availability

The data presented in this study are available upon reasonable request to the corresponding author.

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Appendix: Search Strategy

(Robotic OR Robot-assisted OR Robot) AND (Surgery OR Procedure) AND (Africa OR Algeria OR Angola OR Benin OR Botswana OR "Burkina Faso" OR Burundi OR "Cabo Verde" OR Cameroon OR "Central African Republic" OR Chad OR Comoros OR Congo OR Brazzaville OR Kinshasa OR "Cote d'Ivoire" OR "Ivory Coast" OR Djibouti OR Egypt OR "Equatorial Guinea" OR Eritrea OR Eswatini OR Ethiopia OR Gabon OR Gambia OR Ghana OR Guinea OR Guinea-Bissau OR Kenya OR Lesotho OR Liberia OR Libya OR Madagascar OR Malawi OR Mali OR Mauritania OR Mauritius OR Morocco OR Mozambique OR Namibia OR Niger OR Nigeria OR Rwanda OR "Sao Tome and Principe" OR Senegal OR Seychelles OR "Sierra Leone" OR Somalia OR "South Africa" OR "South Sudan" OR Sudan OR Tanzania OR Togo OR Tunisia OR Uganda OR Zambia OR Zimbabwe).