

Scoping review

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BMJ Open Scoping review: bladder cancer in Nigeria – what are the gaps in clinical care and research?

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ABSTRACT

Objectives There are currently no national guidelines regarding bladder cancer treatment and clinical care pathways in Nigeria. The aim of this scoping review was to identify any gaps in the knowledge of epidemiology, clinical care and translational research in order to aid the development of a defined clinical care pathway and guide future research.

Methods A scoping review was conducted by searching Medline, Ovid Gateway, The Cochrane library and Open Grey literature using predefined search terms from date of inception to June 2020. Studies were included if they discussed the epidemiology or treatment pathway of bladder cancer. All data were charted and were analysed in a descriptive manner. A consultation phase was also conducted consisting of a multidisciplinary team of clinicians and bladder cancer survivors.

Results A total of 19 studies were deemed suitable for inclusion. The themes included the epidemiology of bladder cancer (high prevalence of schistosomiasis), research surrounding the biology of the disease and translational research including potential biomarkers. The consultation phase highlighted some possible sociocultural and infrastructural issues relating to both the diagnosis and treatment of bladder cancer, with poor knowledge of bladder cancer and its symptoms within the general population identified as a key issue.

Conclusion Even though the factors surrounding the relationship between schistosomiasis and the histopathology of bladder cancer remain unclear, there is potential for screening for schistosomiasis in endemic regions of sub-Saharan Africa. Other key areas for future research include the dissemination of information to the general population surrounding bladder cancer and its symptoms to encourage prompt diagnosis.

INTRODUCTION

Being the 10th most common cancer globally, bladder cancer (BC) accounts for 3% of all new cancer cases and 2% of all cancer mortalities.¹ The incidence is rising in Africa, with the highest rates recorded in North Africa. The incidence in North Africa and sub-Saharan

Strengths and limitations of this study

- Grey literature was included as well as indexed journal articles to allow for the collation of data from a variety of sources.
- A consultation phase consisting of a multidisciplinary group of clinicians as well as two bladder cancer survivors was included in the review.
- It is possible that some relevant studies were not accessible on the search engines used for this review, and so some studies may have been overlooked.
- However, our search strategy was methodically developed and several databases were accessed and so we consider this to be unlikely.

Africa have been reported, respectively, as 10.1 and 5.0 per 100 000 for males and 2.0 and 1.5 per 100 000 for females. BC ranks 7th overall (2nd in males and 11th in females) in Nigeria.²

The stage groupings of non-muscle-invasive (NMIBC) and muscle invasive (MIBC) are accepted descriptors of BC in developed countries, with 75%–80% of new cases categorised as the former category and 20%–25% as the latter.³ BC can also be classified into two main groups: urothelial and non-urothelial.⁴ In developed countries, urothelial carcinoma or transitional cell carcinoma (TCC) is the predominant histological subtype of BC,^{5 6} comprising around 90% of all BC cases.⁶ Risk factors for TCC include smoking⁷ and exposure to chemicals in the dye industry.⁸ As it usually presents at an early stage without detrusor muscle involvement (NMIBC), it is associated with a good prognosis.⁹

However, in low/middle-income countries, such as those within the Middle East and parts of Africa, squamous cell carcinoma (SCC), which is the most common variant of non-urothelial carcinoma, is often



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more prevalent than TCC. SCC itself has two main subtypes: schistosomiasis(*Bilharzia*)-associated and non-schistosomiasis-associated SCC, although it is important to note these do not differ morphologically. In the Middle East and parts of Africa where *Schistosoma haematobium* infection is endemic, schistosomiasis-associated SCC is most common. SCC is a more aggressive disease with a poorer prognosis when compared with TCC.¹⁰ In Northern Nigeria, SCC is the most frequent subtype of BC representing 53% of cases despite the lower prevalence of schistosomiasis in Northern Nigeria.¹¹⁻¹³ Meanwhile, in Southern Nigeria, it has been reported that around 20% of BCs were SCC with a higher prevalence of schistosomiasis than in the north.^{14 15} This highlights the possible role of a yet to be identified environmental and/or genetic factor(s), explaining the disparity in histologic type between the northern and southern part of the country.

With a paucity of published evidence relating to the epidemiology, clinical treatment and translational research into BC in Nigeria, this scoping review aims to identify gaps in clinical care and research on BC in Nigeria.

METHODS

Our methodology for this scoping review was developed based on the Joanna Briggs Institute guidelines¹⁶ and, more specifically, the framework developed by Arksey and O'Malley.¹⁷ Unlike other reviews such as systematic reviews which tend to address a precise research question, a scoping review can be used to map and summarise available evidence on a particular subject.¹⁶ They can be conducted for a variety of reasons. This current scoping review was conducted with the aim of identifying the types of available evidence on BC research in Nigeria, with the overall aim of identifying knowledge gaps in this area. Preferred Reporting Items for Systematic Reviews and Meta-Analyses-Scoping Reviews extension for scoping reviews¹⁸ were followed to ensure all suggested items

were reported. A detailed protocol of this scoping review has been published previously¹⁹ and a brief summary is presented in [figure 1](#).

The following research question was developed in consultation with the research and clinical teams:

'What is known about the epidemiology and treatment pathway of BC in Nigeria?'. Medline (using the PubMed interface), Ovid Gateway (Embase and Ovid) (search terms available in online supplemental file 1), The Cochrane library and Open Grey literature were searched for relevant studies between June and July 2020. A separate search for grey literature was conducted by the team in Nigeria through National Postgraduate Medical College of Nigeria, West African College of Surgeons (WACS) and Nigerian Association of Urological Surgeons (NAUS). In addition, verbal communication with most of the tertiary health institutions was instigated to determine the existence of institutional-based protocols.

All types of study design were considered for inclusion if they assessed the themes of prevention, diagnosis, treatment, survivorship or translational research regarding BC in Nigeria. All published studies (excluding grey literature) underwent a critical appraisal using the Joanna Briggs Institute critical appraisal forms (online supplemental file 2).¹⁶ Two independent reviewers charted the data, and the studies identified were analysed using a qualitative method. The studies were split into several subthemes: prevalence, prevention, diagnosis, treatment, survivorship and translational research/biology.

RESULTS

A total of 76 records were identified through database searching after removing duplicates ([figure 2](#)). After screening by title and abstracts, 46 full texts were assessed for eligibility. In total, 19 studies were deemed suitable for inclusion. Of the 19 studies included, 3 were identified through the grey literature search. Initially, the search identified 16 grey literature including six dissertations,

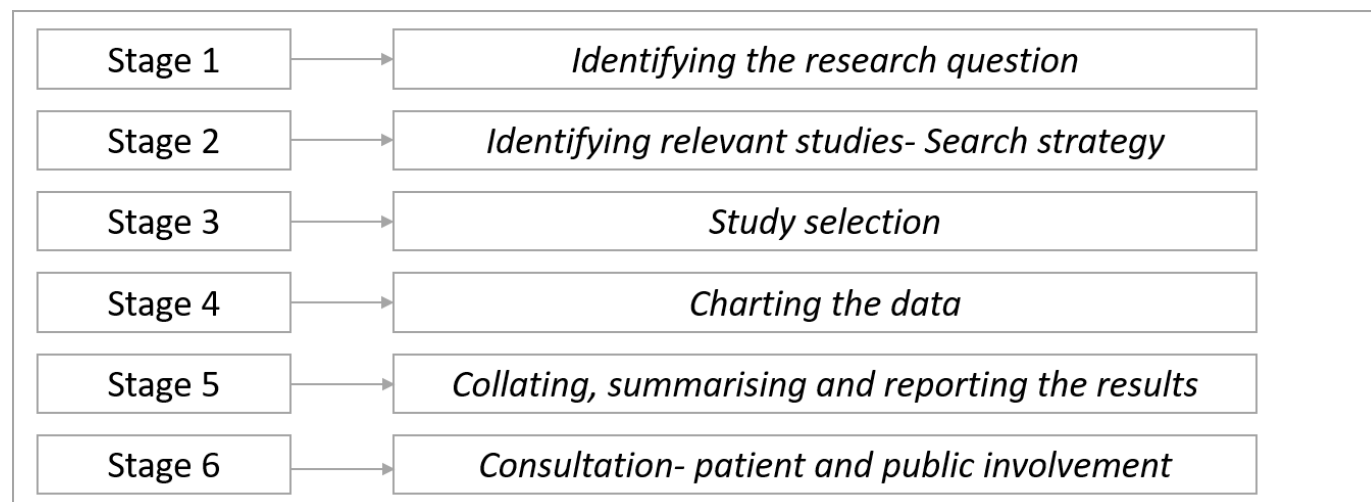
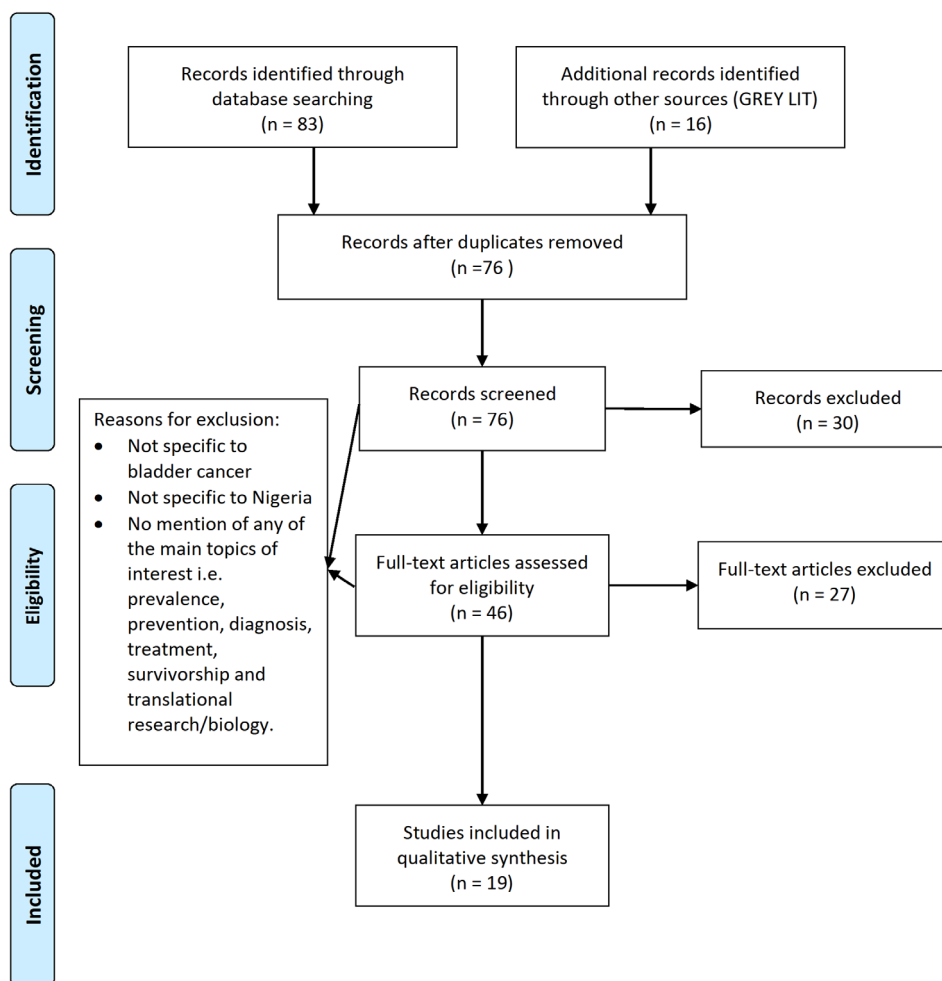


Figure 1 Stages of scoping review.


PRISMA 2009 Flow Diagram


From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit www.prisma-statement.org.

Figure 2 PRISMA flow chart. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

8 conference abstracts and 2 local audits. Thirteen were subsequently excluded during the screening process.

Six studies described the prevalence of BC within the various regions of Nigeria and each listed the prevalence of TCC versus SCC^{12–14 20–22} (tables 1 and 2 and online supplemental file 3). The case series by Ochicha *et al*¹² and Yunusa *et al*²² presented the characteristics of BC patients in Kano (northwest), while the results from Mungadi and Malami¹³ were from Sokoto, also in the northwest. In Kano, the prevalence of TCC was reported to be 35% vs 53% for SCC according to Ochicha *et al*,¹² and 44% SCC vs 29% TCC in the audit by Yunusa *et al*.²² Similarly, Mungadi and Malami stated that the majority (65%) of BC patients had SCC.¹³ Both studies mentioned that there was a strong association between the endemic areas

of schistosomiasis and SCC. Meanwhile and Mbonu²⁰ and Takure *et al*¹⁴ described the prevalence of BC types in Enugu (southeast) and Ibadan (southwest), respectively. The study by Aghaji *et al* stated that 56% had TCC and 39% had SCC, while Takure *et al* concluded that 69% of BC patients had TCC and 20% had SCC.

A common theme among the studies was the need to control the infection of *S. haematobium* for the prevention of BC^{13 23–25} (tables 1 and 2). The study by Umar *et al*²⁵ recommended the implementation of the WHO's mass treatment if the infection of *Schistosoma haematobium* infection is above 50% within a local authority. Ossai *et al*²³ observed a high prevalence of bacteriuria and urinary schistosomiasis in primary school children, which consequently could portend an increased risk of BC in the

Table 1 Overview of included articles

| Study ref | Authors and year | Which region of Nigeria | Aims/objectives | Population |
|-----------|--|--|---|--|
| 1 | Ossai <i>et al</i> ²³ 2012 | Enugu state, south eastern Nigeria | To investigate current prevalence of urinary schistosomiasis and co-infection with bacteriuria in Enugu | 842 primary school children (5–15 years) |
| 2 | Oyeyemi <i>et al</i> ²⁶ 2018 | Illumafon, Ijebu, NorthEast, Ogun state, | To assess the relationship between serum bladder tumour antigen with urinary aflatoxin | 22 participants |
| 3 | Bakare <i>et al</i> ³³ 2018 | Eggua in southwest Nigeria | To determine the association of schistosomiasis and arsenicosis with bladder pathologies | 122 participants |
| 4 | Ochicha <i>et al</i> ¹² 2003 | Kano | To document the pattern of bladder cancer in kano | 89 bladder cancer patients |
| 5 | Aghaji <i>et al</i> ²⁰ 1988 | Enugu | Describe the clinicopathological features of bladder tumours | 103 patients diagnosed with bladder tumours |
| 6 | Onile <i>et al</i> ²⁴ 2016 | Eggua, Yewa, Ogun state, Nigeria | To determine prevalence of schistosomiasis and associated bladder pathology in adults in Eggua. | 257 participants (aged 30+) |
| 7 | Muhammad <i>et al</i> ²⁹ 2019 | Sokoto state | To compare the sensitivity, specificity, and predictive values of bladder tumour antigen quantitative test (BTA TRAK) and urine cytology in the diagnosis of bladder carcinoma in a schistosoma endemic area. | 88 participants (52 participants who had features of bladder carcinoma. The control group had 36 participants who had had haematuria from other urological conditions) |
| 8 | Takure <i>et al</i> ¹⁴ 2015 | Ibadan, Southwest Nigeria | To provide an update on the histopathologic pattern of bladder cancers in Ibadan | 216 bladder cancer patients |
| 9 | Ikurowo <i>et al</i> ³¹ 2018 | Lagos | To report the experience and the outcome of our patients who had this procedure. | Patients who had Radical cystectomy and Mainz II pouch urinary diversion for muscle-invasive bladder cancer from 2007 to 2016 were evaluated. |
| 10 | Shu'aibu <i>et al</i> ³² 2012 | Jos | To report experience with radical cystectomy and W-ileal pouch construction in patients with muscle invasive transitional cell urinary bladder carcinoma. | 6 patients diagnosed with muscle invasive transitional cell bladder carcinoma (T2-3/N0/M0) |
| 11 | Onile <i>et al</i> ²⁸ 2017 | Eggua, South-West Nigeria | To identify biomarkers among the infected population, which will influence early detection of the disease and its subtle morbidity. | Urine samples for 49 volunteers from Eggua, a schistosomiasis endemic community in South-West, Nigeria. |
| 12 | Akinwale <i>et al</i> ³⁴ 2008 | Imala Odo, Abeokuta North Local Government Area of Ogun state, Southwest Nigeria | to screen exfoliated cells in the urine of <i>Schistosoma haematobium</i> -infected patients for squamous cell abnormalities through cytopathological examinations. | A total of 32 infected individuals and 10 uninfected controls (aged between 40 and 55 years) |
| 13 | Ita <i>et al</i> ⁴¹ 2019 | Jos | To describe the case of a Nigerian male with transitional cell carcinoma of the bladder in whom larvae of <i>Strongyloides stercoralis</i> was identified in the urine. | one patient |

Continued

Table 1 Continued

| Study ref | Authors and year | Which region of Nigeria | Aims/objectives | Population |
|-----------|---|-------------------------------|---|---|
| 14 | Mungadi and Malami ¹³ 2007 | Sokoto, North Western Nigeria | To determine the epidemiological characteristics of bladder cancer in the region and to assess the impact of schistosomiasis on these cases. | 133 bladder cancer patients |
| 15 | Oyeyemi <i>et al</i> ²⁷ 2018 | Ogun state | To find the incidence of urinary bladder thickness and evaluate the relationship between BTA and BWT in a low schistosomiasis-endemic Nigerian village. | 56 individuals were screened using chemical reagent strips and then diagnosed microscopically for <i>S. haematobium</i> . |
| 16 | Umar <i>et al</i> ²⁵ 2016 | Kano, Northern Nigeria | To determine the prevalence and human risk factors of <i>S. haematobium</i> infections in Farawa and Koya dam-site communities in Minjibir Local Government Area of Kano State, Northern Nigeria. | 120 individuals |
| 17 | Yunusa <i>et al</i> ²² 2016 | Northern western | To review the burden, pathology and clinical management of bladder cancers in Kano, North-western Nigeria | Patients seen and diagnosed to have bladder cancer |
| 18 | Sani ³⁰ 2018 | North-Western | To determine the efficacy of urine cytology in the diagnosis of bladder cancer, in Aminu Kano Teaching Hospital | 52 patients with suspected bladder cancer |
| 19 | Salako <i>et al</i> ²¹ 201 | South-western Nigeria | To report the changing trend of TCC in our practice at the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria. | 38 bladder cancer patients |

BTA, bladder tumour antigen; BWT, bladder wall thickness; TCC, transitional cell carcinoma.

**Table 2** Identified research gaps and policy recommendations

| Study ref | Authors | Theme | Type of recommendation | Research gaps/recommendation for actions |
|-----------|-------------------------------------|----------------------------------|------------------------|---|
| 1 | Ossai <i>et al</i> ²³ | Prevention | Policy | <ul style="list-style-type: none"> ▶ There is a need for intensive health education to sensitise the people on the risk of urinary schistosomiasis and its co-infection with bacteriuria. ▶ This could be done through community dialogue |
| 2 | Oyeyemi <i>et al</i> ²⁶ | Translational/biology | Research and policy | <ul style="list-style-type: none"> ▶ Need for a study with larger sample size and possibly aflatoxin exposure analysis by serum AF-alb rather than urinary aflatoxin M1 (AFM1) or even a combination of both biomarkers to validate initial this observation of the study. ▶ Study on the role of schistosomiasis in bladder cancer through biomonitoring of human BTA. ▶ Community education of rural agrarian households on best practices to mitigate mycotoxin exposure in farm produce. |
| 3 | Bakare <i>et al</i> ³³ | Translational/biology | Research | <ul style="list-style-type: none"> ▶ Need for a study with larger sample size to study association of schistosomiasis and arsenicosis with bladder pathologies. |
| 4 | Ochicha <i>et al</i> ¹² | Prevalence | N/A | N/A |
| 5 | Aghaji <i>et al</i> ²⁰ | Prevalence | Research and policy | <ul style="list-style-type: none"> ▶ Improve education and diagnostic techniques ▶ Improve therapeutic facilities to reduce morbidity and mortality rates will fall. ▶ Understand impact of socioeconomic status (SES) on presentation |
| 6 | Onile <i>et al</i> ²⁴ | Translational/biology/prevention | Research | <ul style="list-style-type: none"> ▶ Further research on the determinants and progress of the bladder pathologies in <i>Schistosoma haematobium</i> infected Nigerian adults. |
| 7 | Muhammad <i>et al</i> ²⁹ | Diagnosis and translational | N/A | <ul style="list-style-type: none"> ▶ Review the cut-off (of 54 µ/mL) for BTA in the Sokoto region to increase the specificity of the marker for the diagnosis of bladder cancer |
| 8 | Takure <i>et al</i> ¹⁴ | Prevalence | Policy | <ul style="list-style-type: none"> ▶ Train relevant health professionals to enable them to diagnose and treat bladder cancer in its early stages and thus reduce the high morbidity and mortality associated with advanced disease. |
| 9 | Ikuerowo <i>et al</i> ³¹ | Treatment | N/A | N/A |
| 10 | Shu'aibu <i>et al</i> ³² | Treatment | N/A | N/A |
| 11 | Onile <i>et al</i> ²⁸ | Translational/biology/diagnosis | Research | <ul style="list-style-type: none"> ▶ Need for validation of biomarkers in a large sample size |
| 12 | Akinwale <i>et al</i> ³⁴ | Biology | Research | <ul style="list-style-type: none"> ▶ Improve follow-up of these patients using cystoscopy rather than cytology |

Continued

Table 2 Continued

| Study ref | Authors | Theme | Type of recommendation | Research gaps/recommendation for actions |
|-----------|------------------------------------|---|------------------------|--|
| 13 | Ita <i>et al</i> ⁴¹ | Treatment? | Policy | Implement mandatory investigation of <i>S. stercoralis</i> infection for immunocompromised patients |
| 14 | Mungadi and Malami ¹³ | Prevention and prevalence | N/A | N/A |
| 15 | Oyeyemi <i>et al</i> ²⁷ | Diagnosis | Research | <ul style="list-style-type: none"> ▶ The role of urogenital schistosomiasis in urinary BTA levels needs to be further explored. |
| 16 | Umar <i>et al</i> ²⁵ | Prevention | Policy | <ul style="list-style-type: none"> ▶ Implementation of WHO's recommendation for mass treatment of the whole community if infection of <i>S. haematobium</i> infection is >50% by the local authorities. ▶ Screening of the community for bladder pathology by ultrasonography is strongly recommended to assess the risk of development of vesical cancer in aged individuals. |
| 17 | Yunusa <i>et al</i> ²² | Prevention, diagnosis, treatment and survival | Research and policy | <ul style="list-style-type: none"> ▶ Community based studies to get the exact prevalence. ▶ More effort in prevention of schistosomiasis at all levels ▶ Encourage patient to present with early disease through health education. ▶ Screening to detect early disease and surveillance for people with history of childhood haematuria. ▶ Better facilities for cystoscopy and biopsy and other tumour markers |
| 18 | Sani ³⁰ | Diagnosis, treatment and survivorship | Research and policy | <ul style="list-style-type: none"> ▶ Routine use of urine cytology as the initial test for evaluating patients with haematuria or suspected bladder cancer is recommended. ▶ More local studies with longer duration should be done, to allow follow-up of patients over time. In order to validate the importance of urine cytology in detecting recurrence of bladder cancer early in our region. ▶ More education to public on early features of bladder cancer, to facilitate early presentation and opportunity for curative treatment. ▶ There should be increase awareness of schistosomiasis |
| 19 | Salako <i>et al</i> ²¹ | Prevalence | N/A | N/A |

BTA, bladder tumour antigen; N/A, not available.

future. The authors recommended for all primary school children to be screened and treated for bacteriuria.

With respect to the diagnosis of BC and/or schistosomiasis, five studies investigated potential biomarkers and/or the use of urine cytology²⁶⁻³⁰ (tables 1 and 2). The two studies by Oyeyemi *et al* looked at the association between

bladder tumour antigen (BTA) with other factors. The first of the studies, looked at whether BTA levels were associated with aflatoxin exposure (a fungal metabolite) in Nigerian villagers.²⁶ The study concluded a null result with no evidence of a link between aflatoxin exposure and BTA. The second study by the same group of authors,



investigated the relationship between BTA and bladder wall thickness (BWT) in a low schistosomiasis-endemic Nigerian village.²⁷ They reported no association between BWT and BTA and lower urinary tract symptoms, and suggested that the role of urogenital schistosomiasis in urinary BTA levels needed to be explored further. Meanwhile, the study by Muhammad *et al* looked at the role of a quantitative test (BTA TRAK) compared with urine cytology in the diagnosis of BC in the schistosome endemic area of Sokoto.²⁹ The authors concluded that BTA TRAK is less specific than urine cytology, but is more sensitive for detecting BC in the area of investigation. The study by Onile *et al* differed in that they identified several parasite-specific and host-specific protein biomarkers for the detection of schistosomiasis.²⁸ The dissertation, which was identified as part of the grey literature search, was submitted to the WACS as part of the requirements for the award of fellowship of the college in surgery. This dissertation aimed to assess the efficacy of urine cytology in the diagnosis of BC and deemed the use of urine cytology as an effective way of diagnosing patients who present with features indicative of BC.³⁰

Two case series reported their experiences of patients undergoing radical cystectomy with different urinary diversion techniques^{31 32} (table 1). The first by Ikurowo *et al* looked at the outcome of a Mainz II pouch urinary diversion in radical cystectomy patients.³¹ They concluded that over the 10-year period investigated, 11 patients underwent a Mainz II pouch urinary diversion and overall the technique was deemed safe with good long-term results. The second by Shu'aibu *et al* report their experience of patients who underwent radical cystectomy with a W-ileal pouch construction over a 5-year period.³² Six patients underwent the procedure, of which only one patient remained alive 5 years after surgery (although two were lost to follow-up). The authors described the technique as a complex procedure requiring highly experienced surgeons and surgical team.

In terms of the biological effects surrounding schistosomiasis, three studies each looked at how this was related to arsenicosis,³³ bladder pathology²⁴ and urothelial hyperplasia³⁴ (tables 1 and 2). Bakare *et al* stated that Arsenicosis was a public health concern for the study population of Eggua, situated in South-West Nigeria and that the prevalence of schistosomiasis was 21%.³³ Notwithstanding, there was no association between bladder pathology and arsenicosis or between schistosomiasis associated-bladder pathology and arsenicosis. Also conducted in Eggua, the study by Onile *et al* involved the screening of 257 adults for *S. haematobium* infection and associated bladder pathologies.²⁴ The prevalence of *S. haematobium* infection was found to be 26% and bladder pathologies were observed in 34% of participants.²⁴ A large proportion of the patients with bladder pathology also had existing schistosomiasis infection (85%). The study by Akinwale *et al* involved participants from Imala Odo which is also an area within South-West Nigeria.³⁴ The 780 strong community has no basic infrastructure and is made up of migrant

fishing families. The authors observed severely dysplastic malignant squamous cells among a few normal squamous cells in three patients (out of 32). They subsequently state that their results support a Kenyan study which showed an association between urinary tract hyperplasia and *S. haematobium* infection.³⁵

The consultation phase included discussion between two consultant urologists, a urology senior registrar, a consultant oncologist, a consultant pathologist, a consultant interventional radiologist, a consultant public health physician, a consultant clinical microbiologist, an oncology pharmacist, a cancer nurse specialist and two BC survivors. The topics of epidemiology, the clinical care pathway and translational research were discussed. There was a general consensus that, although schistosomiasis was endemic in certain areas, this did not always reflect the proportion of SCC versus TCC observed. The clinicians discussed a missing link in this association which was yet to be identified but proposed access to fresh water as a possible cause. In terms of the clinical care pathway, there was an absence of a national standardised pathway. Instead, hospitals would implement local pathways based on personal experiences. The clinicians therefore recommended the development of national guidelines and pathways. Translational research was identified as a rarity in most areas of Nigeria with infrastructure and funding being the main two hindering factors. There was much discussion around the potential benefits of a biobank and better use of the already existing national data registry which at present only captures diagnostic information. The clinicians also spoke about the reluctance by some patients to accept treatments particularly, those that are injectable.

Both of the patient representatives were males of retirement age with no previous family history of BC. They did, however, have very different experiences in terms of their diagnosis and cancer care. Patient A had to undergo seven different hospital visits before undergoing transurethral resection of bladder tumour. Patient B also had initial difficulties in getting access to care, but was financially able to opt for treatment at an alternative hospital for radical cystectomy. The patients spoke about the general lack of awareness of BC in Nigeria and, although neither one refused treatment, patient A decided to also take traditional herbal medicines alongside his medical treatment.

DISCUSSION

The most commonly studied topic was the prevalence of SCC and TCC and its link with schistosomiasis. Despite there being a lack of clarity behind the link between the histopathology of BC and schistosomiasis, it was clear from the review that schistosomiasis is a major problem in Nigeria and there are strong links surrounding an increased risk of BC of any type. Several studies investigated potential biomarkers for BC such as BTA. There was, however, a paucity of studies discussing the clinical

pathways for BC patients in Nigeria. The consultation phase re-iterated many points found in the research articles, including a lack of national guidelines or protocols for the treatment of BC patients.

The results of this review, including the consultation phase with a multidisciplinary group of professionals and patient representatives, have highlighted numerous key issues for which several recommendations are outlined below.

Epidemiology

As presented in this review, there is disparity between the incidence of TCC and SCC in different regions of Nigeria. Despite schistosomiasis being more prevalent in the southern regions of the country,¹⁵ there is not always a clear correlation between schistosomiasis and SCC prevalence, with TCC ever becoming the most common histology nationwide. The studies identified within this scoping review did not investigate this important area of research, but did confirm the higher prevalence of TCC in the south.^{14 20} More studies are therefore needed to investigate the factors underlying the link between schistosomiasis and SCC vs TCC prevalence. Another factor which may be important to consider also is tobacco smoking which is a known risk factor for both SCC and TCC.^{36 37} Future studies in this area could include ecological analyses to evaluate and incidence of BC types as well as *Schistosoma* over time.

The prevention and mass treatment of schistosomiasis was investigated within four of the studies from this review; therefore, this area of research is not as neglected as others. Umar *et al* recommended for the utilisation of mass treatment, as suggested by the WHO²⁵; however, it is important to note that despite mass drug administration to curb the infection rates, there still remains a lack of transmission control and provision of good water supply which has meant the mortality from the infection has not decreased significantly.³⁸

Clinical care pathways

None of the studies identified within this review investigated the clinical care pathways for BC patients in Nigeria, although two did present case series of radical cystectomy patients undergoing different urinary diversion techniques. Interestingly, the study by Shu'aibu *et al*,³² which investigated the outcomes of patients undergoing an W-ileal pouch urinary diversion, lost two of their six patients during follow-up; this issue emerged during the consultation phase whereby it was suggested that contact with patients post-treatment can be challenging. No other treatment modalities (eg, intravesical therapy, radiotherapy) were mentioned within the literature identified within this scoping review.

At present, the NAUS only have guidelines available for the treatment of prostate cancer patients. Nevertheless, as highlighted during the consultation phase of this review, despite a paucity of national guidelines regarding the treatment pathway for BC patients in Nigeria, this does

not mean that patients receive suboptimal care by their treating physicians. Many hospitals, in particular tertiary centres, have developed their own sets of guidelines based on previous experiences; other centres may refer to or adapt existing national/international guidelines that already exist. However, there is still a call for the inauguration of national guidelines to ensure standardisation and continuity of care across the country, and this is a topic worthy of specific future studies.

A topic which was raised during the consultation phase of this review was the lack of communication between the clinical and pharmaceutical aspects of patients' care. For example, the availability of drugs can at times be an issue and can lead to delays in treatment. A recommendation in this area would be for clinical and pharmaceutical departments to collaborate more closely so as to better coordinate the clinical needs for patients within the resources available.

It was highlighted during the consultation phase that the majority of BC patients in Nigeria present at an advanced disease stage and that this is reflected by poor survival statistics (though we do not have data to quantify this). Patients are often of low financial means and from rural areas with insufficient or no medical insurance. A fundamental concern is how to improve this scenario and raise awareness of BC and its symptoms. Hence, patient education is vital and, as highlighted by patient representatives during the consultation phase, knowledge of symptoms and disease risk factors could prompt patients to seek clinical help sooner. Such an awareness campaign has existed for breast cancer in Nigeria and has proved to be effective.³⁹ Furthermore, non-invasive diagnostic techniques (such as ultrasonography) could be implemented to limit the numbers of patients discouraged in seeking medical consultation by the perception of cystoscopy. In addition, there needs to be a focus on the early diagnosis of patients. As a result of patients being diagnosed in a timely manner, it is hoped this will then allow for the well-being of BC survivors to be investigated. This area of research was lacking in the studies identified within this review and is therefore a recommended area for future research.

Translational research

It was evident from this review that some research had been undertaken surrounding the link between biomarkers and other factors. Two studies, by the same group of authors, looked at the link between BTA and BWT and aflatoxin, with no association identified. BTA-TRAK is a US Food and Drug Administration (FDA) approved immuneassay for the monitoring of BC recurrence when used in conjunction with cystoscopy.⁴⁰ It has been noted, however, that while BTA assays have higher sensitivity than urine cytology, the specificity is lower therefore leading to more false-positives.⁴⁰ This is an important factor to consider when BTA is being used as a surrogate for BC pathology (as reported by Oyeyemi *et al*²⁶).

The BC patients in Nigeria are often from high risk groups such as farmers and fishermen, who are exposed to bodies of water infected with *S. haematobium*. Many patients also have a cultural belief that injectable medicines are harmful and therefore often abscond from treatment. This is particularly difficult for the treating clinician when many beneficial drugs (eg, cytotoxic chemotherapy) are administered intravenously. Therefore, for these patients, education is key. A possible solution would be the adoption of cancer support groups or cancer charities which focus on patients' needs and well-being. These groups can be an excellent source of education and emotional support for patients, particularly for those without a stable domestic support system.

Further to the gaps in research highlighted by this review, there is also a challenge in identifying enough clinicians and/or academics to conduct the necessary future research, as well as the enabling of resources and infrastructure. Translational research within a laboratory setting can be a costly affair and usually requires funding through research grants. A future recommendation in this area could be the set-up of local or regional biobanks in order to store tumour specimens for research purposes, although establishing such an infrastructure should be considered in the context of the other priorities outline above.

Strengths and limitations

This review aimed to identify the gaps in clinical care and research for BC in Nigeria as part of the development of a larger national research programme, an endeavour which has not previously been undertaken. We anticipated that there would be a limited number of studies on the subject of interest, and so included grey literature as well as indexed journal articles to allow for the collation of data from a variety of sources. Another strength was the inclusion of a consultation phase with a multidisciplinary group of clinicians as well as two BC survivors. This process gave invaluable information on a personal level which would not have been achieved from the literature alone. We utilised the Joanna Briggs Institute critical appraisal tools to determine whether to include studies in the review. In this case, all studies were deemed suitable for inclusion. It is possible that some relevant studies were not accessible on the search engines used for this review, and so some studies may have been overlooked. However, our search strategy was methodically developed and several databases were accessed and so we consider this to be unlikely.

CONCLUSION

This scoping review has identified several themes regarding the epidemiology and clinical care pathways of BC patients in Nigeria which require further research and development. Despite the existing knowledge of the link between schistosomiasis and SCC, this review highlighted that the correlation between these two diseases is

not always clear and can differ between regions. Therefore, the investigation of factors affecting the prevalence of SCC vs TCC and its relationship with *S. haematobium* infection is just one research area requiring attention. There is also a need for both national and hospital guidelines for BC care in Nigeria. Further recommendations include the need to better educate the general population regarding BC and its symptoms to improve early diagnosis. It is hoped that the results and recommendations from this scoping review can pave the way for the development of BC guidelines within Nigeria as well as guiding future research.

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Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

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Search strategy for Ovid Gateway (Embase and Ovid)

Search terms used: Bladder cancer.mp AND nigeria.mp

We had no further filters or date restrictions in our search in order to cover as much content as possible.

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Ossai et al. Year 2014 Record Number 1

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Were the criteria for inclusion in the sample clearly defined? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were the study subjects and the setting described in detail? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the exposure measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were objective, standard criteria used for measurement of the condition? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Were confounding factors identified? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Were strategies to deal with confounding factors stated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were the outcomes measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Was appropriate statistical analysis used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Oyeyemi et al. Year 2018 Record Number 2

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| • Were there clear criteria for inclusion in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was the condition measured in a standard, reliable way for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were valid methods used for identification of the condition for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have consecutive inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have complete inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the demographics of the participants in the study? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of clinical information of the participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were the outcomes or follow up results of cases clearly reported? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the presenting site(s)/clinic(s) demographic information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was statistical analysis appropriate? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Bakare et al. Year 2018 Record Number 3

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Were the criteria for inclusion in the sample clearly defined? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were the study subjects and the setting described in detail? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the exposure measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were objective, standard criteria used for measurement of the condition? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Were confounding factors identified? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Were strategies to deal with confounding factors stated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were the outcomes measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Was appropriate statistical analysis used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

B Russell JBI Critical Appraisal Checklist for Case Series

Reviewer _____ Date June 2021

Author Ochicha et al. Year 2003 Record Number 4

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| • Were there clear criteria for inclusion in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was the condition measured in a standard, reliable way for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were valid methods used for identification of the condition for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have consecutive inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have complete inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the demographics of the participants in the study? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of clinical information of the participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were the outcomes or follow up results of cases clearly reported? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the presenting site(s)/clinic(s) demographic information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was statistical analysis appropriate? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

B Russell JBI Critical Appraisal Checklist for Case Series

Reviewer _____ Date June 2021

Author Aghaji and Mbonu Year 1988 Record Number 5

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| • Were there clear criteria for inclusion in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was the condition measured in a standard, reliable way for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were valid methods used for identification of the condition for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have consecutive inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have complete inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the demographics of the participants in the study? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of clinical information of the participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were the outcomes or follow up results of cases clearly reported? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the presenting site(s)/clinic(s) demographic information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was statistical analysis appropriate? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Onile et al. Year 2016 Record Number 6

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Were the criteria for inclusion in the sample clearly defined? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were the study subjects and the setting described in detail? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the exposure measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were objective, standard criteria used for measurement of the condition? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Were confounding factors identified? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Were strategies to deal with confounding factors stated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were the outcomes measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Was appropriate statistical analysis used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Muhammad et al. Year 2019 Record Number 7

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Were the criteria for inclusion in the sample clearly defined? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were the study subjects and the setting described in detail? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the exposure measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were objective, standard criteria used for measurement of the condition? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Were confounding factors identified? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Were strategies to deal with confounding factors stated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were the outcomes measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Was appropriate statistical analysis used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Takure et al. Year 2015 Record Number 8

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| • Were there clear criteria for inclusion in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was the condition measured in a standard, reliable way for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were valid methods used for identification of the condition for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have consecutive inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have complete inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the demographics of the participants in the study? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of clinical information of the participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were the outcomes or follow up results of cases clearly reported? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the presenting site(s)/clinic(s) demographic information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was statistical analysis appropriate? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR COHORT STUDIES

Reviewer B Russell Date June 2021

Author Ikuerowo et al. Year 2018 Record Number 9

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Were the two groups similar and recruited from the same population? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were the exposures measured similarly to assign people to both exposed and unexposed groups? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the exposure measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were confounding factors identified? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Were strategies to deal with confounding factors stated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were the outcomes measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Was the follow up time reported and sufficient to be long enough for outcomes to occur? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Were strategies to address incomplete follow up utilized? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. Was appropriate statistical analysis used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

Whilst sufficient statistical analyses were used, the authors could have performed more sophisticated approaches such as logistic regression models.

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Shu'aibu et al. Year 2012 Record Number 10

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| • Were there clear criteria for inclusion in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was the condition measured in a standard, reliable way for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were valid methods used for identification of the condition for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have consecutive inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have complete inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the demographics of the participants in the study? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of clinical information of the participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were the outcomes or follow up results of cases clearly reported? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the presenting site(s)/clinic(s) demographic information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was statistical analysis appropriate? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Onile et al. Year 2017 Record Number 11

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| • Were there clear criteria for inclusion in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was the condition measured in a standard, reliable way for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were valid methods used for identification of the condition for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have consecutive inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have complete inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the demographics of the participants in the study? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of clinical information of the participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were the outcomes or follow up results of cases clearly reported? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the presenting site(s)/clinic(s) demographic information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was statistical analysis appropriate? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Akinwale et al. Year 2008 Record Number 12

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| • Were there clear criteria for inclusion in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was the condition measured in a standard, reliable way for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were valid methods used for identification of the condition for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have consecutive inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have complete inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the demographics of the participants in the study? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of clinical information of the participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were the outcomes or follow up results of cases clearly reported? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the presenting site(s)/clinic(s) demographic information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was statistical analysis appropriate? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR CASE REPORTS

Reviewer B Russell Date June 2021

Author Ita et al. Year 2019 Record Number 13

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Were patient's demographic characteristics clearly described? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Was the patient's history clearly described and presented as a timeline? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the current clinical condition of the patient on presentation clearly described? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were diagnostic tests or assessment methods and the results clearly described? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Was the intervention(s) or treatment procedure(s) clearly described? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Was the post-intervention clinical condition clearly described? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were adverse events (harms) or unanticipated events identified and described? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Does the case report provide takeaway lessons? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI Critical Appraisal Checklist for Case Series

Reviewer B Russell Date June 2021

Author Mungadi and Malami Year 2007 Record Number 14

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| • Were there clear criteria for inclusion in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was the condition measured in a standard, reliable way for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were valid methods used for identification of the condition for all participants included in the case series? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have consecutive inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Did the case series have complete inclusion of participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the demographics of the participants in the study? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of clinical information of the participants? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Were the outcomes or follow up results of cases clearly reported? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was there clear reporting of the presenting site(s)/clinic(s) demographic information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| • Was statistical analysis appropriate? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Oyeyemi et al. Year 2018 Record Number 15

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Were the criteria for inclusion in the sample clearly defined? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were the study subjects and the setting described in detail? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the exposure measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were objective, standard criteria used for measurement of the condition? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Were confounding factors identified? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Were strategies to deal with confounding factors stated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were the outcomes measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Was appropriate statistical analysis used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

JBI CRITICAL APPRAISAL CHECKLIST FOR ANALYTICAL CROSS SECTIONAL STUDIES

Reviewer B Russell Date June 2021

Author Umar et al. Year 2016 Record Number 16

| | Yes | No | Unclear | Not applicable |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. Were the criteria for inclusion in the sample clearly defined? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were the study subjects and the setting described in detail? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the exposure measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Were objective, standard criteria used for measurement of the condition? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Were confounding factors identified? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Were strategies to deal with confounding factors stated? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were the outcomes measured in a valid and reliable way? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Was appropriate statistical analysis used? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Overall appraisal: Include Exclude Seek further info

Comments (Including reason for exclusion)

Supplementary Table 1. Summary of results

| Study Ref | Article title | Authors and Year | Conclusion |
|-----------|---|---------------------------|---|
| 1 | Bacteriuria and urinary schistosomiasis in primary school children in rural communities in Enugu State, Nigeria | Ossai et al. 2012 [23] | The study concluded there was a high prevalence of bacteriuria co-infection among children with urinary schistosomiasis in Enugu State and recommended the need for concurrent antibiotics administration and follow-up to prevent later complications. |
| 2 | A pilot biomonitoring study of bladder tumor antigen (BTA) in aflatoxin exposed Nigerian villagers. | Oyeyemi et al. 2018 [26] | The authors concluded there may not be a correlation between BTA and aflatoxin |
| 3 | Arsenicosis in bladder pathology and schistosomiasis in Eggua, Nigeria. | Bakare et al. 2018 [33] | The authors found no association between arsenicosis and bladder arsenicosis. There was also no association between schistosomiasis associated-bladder pathology and arsenicosis. |
| 4 | Bladder cancer in Kano-- a histopathological review. | Ochicha et al. 2003 [12] | Mean age 48.8 years. 53% of tumours were squamous and 35% TCC (two most common types). Over 75% of biopsies were taken from schistosomiasis endemic areas. Male to female ratio 5.1:1. |
| 5 | Bladder tumours in Enugu, Nigeria | Aghaji et al. 1988 [20] | The results support a strong association between schistosomiasis and bladder cancer. 56% TCC, 38.8% SCC |
| 6 | Detection of urinary tract pathology in some schistosoma haematobium infected Nigerian adults. | Onile et al. 2016 [24] | There is evidence that <i>S. haematobium</i> infections may be associated with bladder pathology, on ultrasound examination. Individuals with bladder pathologies could have heavy or light intensity of schistosomiasis infection or have no existing infection at all. However, a long term exposure to schistosomiasis is necessary for the development of bladder cancer. |
| 7 | Effectiveness of bladder tumor antigen quantitative test in the diagnosis of bladder carcinoma in a schistosoma endemic area. | Muhammad et al. 2019 [29] | The authors concluded that BTA TRAK is more sensitive but poorly specific as compared to that of the urine cytology for bladder cell carcinoma detection in a schistosoma endemic area. |
| 8 | Histopathologic Pattern of Bladder Cancers in Ibadan Southwest Nigeria: An Update. | Takure et al. 2015 [14] | The authors concluded that urothelial carcinoma was the predominant type of bladder cancer in Ibadan. Both urothelial and squamous cell carcinomas occur earlier in women. |
| 9 | Outcome of Mainz II Pouch Urinary Diversion after Radical Cystectomy in Patients with Muscle-invasive Bladder Cancer: Our Experience. | Ikuero et al. 2018 [31] | The authors concluded that Mainz II pouch urinary diversion is safe and acceptable to most of our patients with good long-term results. |
| 10 | Preliminary experience with radical cystectomy and w-ileal pouch for muscle invasive transitional cell bladder carcinoma. | Shu'aibu et al. 2012 [32] | Study is small but highlights the challenges of surgical management of patients with muscle invasive transitional cell carcinoma of the urinary bladder in a resource-constrained setting. |
| 11 | Quantitative label-free proteomic analysis of human urine to identify novel candidate protein biomarkers for schistosomiasis. | Onile et al. 2017 [28] | This study demonstrates that urinary proteomics is a viable approach to discovering candidate biomarkers for schistosomiasis and its associated pathology, but the results presented here require validation in a larger cohort before clinical applications can be considered. |

| | | | |
|----|--|------------------------------|---|
| 12 | Squamous cell abnormalities in exfoliated cells from the urine of Schistosoma haematobium-infected adults in a rural fishing community in Nigeria. | Akinwale et al. 2008 [34] | Our results showed an association between urinary tract hyperplasia and S. haematobium infection |
| 13 | Strongyloides stercoralis larvae in the urine of a patient with transitional cell carcinoma of the bladder: a case report. | Ita et al. 2019[41] | This case report highlights the need for physicians working in areas that are endemic for S. stercoralis to investigate immunocompromised patients for S. stercoralis infection given the poor prognosis of disseminated infection in this group of patients. |
| 14 | Urinary bladder cancer and schistosomiasis in North-Western Nigeria. | Mungadi and Malami 2007 [13] | The association with chronic urinary schistosomiasis and bladder cancer is very strong and the hospital incidence appears to be rising. |
| 15 | Urinary bladder thickness, tumor antigen, and lower urinary tract symptoms in a low Schistosoma haematobium-endemic rural community of Nigeria. | Oyeyemi et al. 2018 [27] | The study concluded that high occurrence of BTA and BWT in the individuals indicates high risk of urothelial carcinoma and urinary bladder irritation, respectively. Combination of BWT and other self-reported LUTS could moderately diagnose BTA in urine. |
| 16 | Schistosoma haematobium Infections: Prevalence and Morbidity Indicators in Communities around Wasai Dam, Minjibir, Kano State, Northern Nigeria | Umar et al. 2016 [25] | The study concluded that the proximity of the communities to the Dam portends continuous unprotected exposure to the cercariae-infested water by individuals for various purposes, hence continuous manifestation of morbidity indicators because of recurrent infections. |
| 17 | Bladder Cancer Burden and Challenges of Management in Kano, North Western Nigeria | Yunusa et al. 2016 [22] | Squamous cell carcinoma is still the predominant histological subtype of bladder cancer in our environment owing to endemicity of schistosomiasis and usually present in advanced stage. |
| 18 | Efficacy of Urine Cytology in the Diagnosis of Bladder Cancer in Aminu Kano Teaching Hospital: Comparison of Cytology and Histological Findings | Dr Auwal Sani 2018 [30] | Based on the findings from this study, Urine cytology is an effective method for evaluation of patients presenting with features suggestive of bladder cancer. Routine use of urine cytology as the initial test for evaluating patient with suspected bladder cancer is recommended. |
| 19 | Changing Trends of Transitional Cell Carcinoma of the Bladder in Ile-Ife | Salako et al. 2019 [21] | TCC is rising in proportion amongst other types of bladder cancer. It is the commonest bladder cancer seen associated with cigarette smoking and industrial exposure to carcinogens. |