Urologic care of nonagenarians: A retrospective chart review

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Cite as: Chadrawe E, Lobo A, Lawen T, et al. Urologic care of nonagenarians: A retrospective chart review. *Can Urol Assoc J* 2024 June 10; Epub ahead of print.
http://dx.doi.org/10.5489/cuaj.8763

Published online June 10, 2024

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ABSTRACT

Introduction: Nonagenarians represent a rapidly growing patient population in Canada with unique health concerns. With the goal of preparing urologists to manage this complicated patient populations in the future, we sought to characterize referral patterns, diagnoses, investigations, treatments, and associated complications in a cohort of nonagenarians. Our second goal was to review anticholinergic burden (ACB) and rates of anticoagulation in this patient population and to assess the risk of hematuria in those who were anticoagulated.
Methods: This was a single-center, retrospective chart review of a sample of nonagenarians referred to our tertiary care centre between 2009 and 2017. Demographic information, referral patterns, investigations, treatment plans, and outcomes were assessed. We assessed medication lists to calculate ACB scores at the time of referral, in addition to rates of anticoagulation use.
Results: Data was collected for 154 nonagenarians. Hematuria was the most common reason for referral (n=43, 27.9%). Urinary retention and lower urinary tract symptoms (LUTS) were seen in 22 and 36 patients, respectively. The majority of patients underwent routine investigations; however, treatment decisions were frequently based on age and frailty. Mild, moderate and severe ACB scores were seen in 76.6%, 9.33%, and 14.0%, respectively. Of those referred for hematuria, 78.1% were on anticoagulation therapy.
Conclusions: The most common reasons for urologic referral of nonagenarians include hematuria and LUTS. Most nonagenarians are offered routine investigations, and many are offered minor interventions for common benign and malignant urologic diagnoses. When treating nonagenarians, an individualized patient-centered care approach is likely most appropriate.

INTRODUCTION

Life expectancy in Canada has been steadily increasing and this increase is expected to continue. Centenarians make up the second largest growing population in the country with a 25.7% increase from 2006 to 2011. This means physicians are seeing more patients in their nineties. Currently there are 323,069 Canadian nonagenarians, which corresponds to a 12.5% increase from 4 years ago.[1] Urologists manage a number of diagnoses associated with aging that influence both quality of life and mortality such as incontinence, cancer, bladder outlet obstruction and urinary tract infections. In fact, one study showed 46.2% of Americans 65 years of age and over enrolled in Medicare visit a urologist, making up the third most common specialist behind ophthalmology and cardiology.[2] Furthermore, 65% of all urologic operations are performed on patients 65 years or older.[3]

Physiologic decline associated with aging influences medical and surgical outcomes. Surgical complications are higher in older urology patients, defined as 65 years and older, including: delirium, ICU admission, decline in functional status and death.[3] Although there are a number of indices and scales to assess preoperative risk and frailty, studies have not shown these frailty scores to correspond to surgical outcomes in urology.[4] Furthermore, there are no specific guidelines for determining which patients are suitable for intervention. Surgeons use a combination of clinical judgement, evidence and patient wishes when considering investigation and treatment options.

Urology offers a spectrum of management decision from conservative, medical and surgical. Evidence needed to inform decision making in this expanding population is lacking. Research in this field is necessary both for preventing patients from being subjected to potentially harmful treatments, but also to ensure they are not being under treated for fear of adverse outcome based on age alone.

Pridgeon et al investigated the use of urologic hospital services by nonagenarians. They found the most common presentations at the UK General Hospital were hematuria (41%) and urinary retention (35%). They also found this group had longer hospital admissions compared to octogenarians with similar presentations.[5]

Our study is an observational retrospective chart review of nonagenarians presenting to urologists at a major health centre in Eastern Canada. The goal was to characterize referral patterns, diagnoses, investigations, treatments and associated complications. As medication review is an important part of comprehensive geriatric assessment, our second goal was to review anticholinergic burden in this patient population and rates of anticoagulation.

METHODS

The study was approved by the local ethics board (file no. 1022871) as a retrospective chart review. The nonagenarian database was formulated from a sample of referrals made to 8 urologists with a variety of sub specialties from our tertiary care centre in Halifax from 2009-2017. The only inclusion criteria was age 90-99 at time of referral. Referrals from outpatient, inpatient and emergency departments were included. A total of 154 patients were sampled out of

approximately 700 referrals, and 2 were excluded for incomplete records for a final total of 152 patients.

Information was gathered through the provincial electronic medical record (EMR) in conjunction with the EMR used by the urology department. The charts were reviewed for demographics (age, gender, residence, number of comorbidities), the source of referral, the reason for referral, diagnosis, investigations and treatment information. Medication lists were also recorded specifically for anticoagulation therapy and calculation of anticholinergic burden. We chose to study these medication classes because the use of anticholinergic medications and anticoagulation can contribute to lower urinary tract symptoms and hematuria, respectively. The Anticholinergic Cognitive Burden Scale (ACB) was used to calculate anticholinergic burden.[6]

Statistical analysis was mostly through descriptive statistics with reported frequencies and percentages. Normality analysis using Shapiro-Wilk demonstrates non-normality for ACB and anticoagulation, therefore median and interquartile ranges were reported. Non-parametric Chi-square test was used for anticoagulation and anticholinergic data comparisons. Alpha of 0.05 was used for determining significance.

RESULTS

A total of 152 nonagenarians were referred to urology during the abovementioned timeframe and were included in the study. The average age was 92.3 years. A majority of patients were male (77.0%) and living independently at home (58.6%). With respect to baseline health, the proportion of patients with 1-5 versus 6-10 comorbid illnesses was similar (**Table 1**). Common comorbidities included cardiac disease (40.5%), followed by cancer (34.6%), diabetes (13.1%) and stroke (11.7%). Only 8.5% of subjects had reported dementia. A previous urologic diagnosis was found in 33.3% of patients.

Referrals and diagnosis

In this pre-COVID cohort, referrals were received from family doctors in 59.9% of cases. Only 23 referrals were sent from the emergency department (15.1%). The average wait time from date of referral to appointment was 73.5 days.

The most common reason for referral was hematuria (n=43, 28.3%), followed by lower urinary tract symptoms (LUTS) for 23.0% of cases. The “other” category of referrals included hydronephrosis, phimosis/penile lesions and bladder tumours (**Table 2**). The most common diagnosis was malignancy. The breakdown of urologic cancers was: bladder (n=18), prostate (PCa, n=19), renal (n=3) and penile (n=1).

For those referred for hematuria, bladder cancer was the most common diagnosis (n=17), while 60.5% of hematuria was not related to malignancy. Eight patients had no known cause for hematuria found after investigations of both the upper and lower urinary tracts. Urinary tract infection was diagnosed in 3 patients, radiation cystitis was found in 3 patients, and trauma from catheterization was the cause for 2 patients.

INVESTIGATIONS

Table 3 outlines the investigations ordered in this cohort of nonagenarians. The most common investigation arranged by Urologists was cystoscopy under local anesthetic, which was offered to 81 patients (51.3%). The second most common investigation was imaging (n=53). A small proportion of patients did not undergo any investigations (n=13, 8.2%). Although 10 patients presented with elevated PSA, none underwent a prostate biopsy.

Treatment

The mainstay of treatment was conservative measures (i.e. no medical or surgical treatment) for 48.0% of patients. New medication prescriptions were given to 58 patients (36.7%). The most common medication prescribed was an antibiotic. (Table 3).

Surgical procedures were performed in 39 patients. The most common procedures were related to gross hematuria. This includes: transurethral resection of bladder tumour (TURBT, n=13) and rigid cystoscope, fulguration and evacuation of clots (n=5). Four patients underwent a transurethral resection of the prostate (TURP). Overall, 6 patients were treated for urolithiasis, 3 with ESWL and 3 with laser lithotripsy. Other procedures included: circumcision, ureteral stent placement, penectomy, excision of urethral caruncle, and Bulkamid® injections.

Complications were reported in 8/39 (20.5%) patients after undergoing procedures. This included re-admission for AUS erosion, urinary retention after cystoscopy, urosepsis after ureteroscopy and laser lithotripsy of stone, acute renal failure after stent placement, minor bleeding, gross hematuria (one required take-back to the operating room post-TURP, and two required CBI after TURBT). There was one recorded mortality secondary to acute renal failure from ureteric compressive lymphadenopathy in a patient with metastatic PCa.

We assessed reasons to not pursue standard treatment. We found 36 patient medical reports explicitly cited “age” or subjective “ frailty” for reasons that both the urologist and/or the patient declined conventional treatment. Fifteen out of the 36 patients did not want to undergo any additional investigations or procedures as they were content with their current health and did not think they would act on the results of the investigation or did not want any medications or surgeries that could worsen their quality of life. For the remaining 21 cases, common reasons for altering treatment plans included surgeon concern regarding the risk of medication side effects, for example not prescribing anticholinergics for patients at risk of falls or with dementia. Several patients were deemed inappropriate surgical candidates due to age and comorbidities. Of the 19 patients diagnosed with PCa, 9 had comments in their chart that they would not be offered intervention, either androgen deprivation therapy or surgery, because of their age and/or frailty as they were not symptomatic and the cancer is typically slow growing.

Anticholinergic burden

Nonagenarians referred to urology were typically on 1-5 medications (54.6%) (Table 1). Anticholinergic burden was measured based on the Anticholinergic Cognitive Burden Scale where 1 is mild, 2 is moderate and 3+ is considered severe anticholinergic burden. Anticholinergic burden was 0-1 (mild) in 76.2% of patients (Table 4). Only 13.9% of patients

were considered to have a high anticholinergic burden. The most common medications to contribute to high anticholinergic burden were oxybutynin and SSRIs.

The median ACB for patients referred for LUTS was 1.0 with an IQR 1.3, which represents a statistically significant difference compared to the median ACB in this cohort of 0.96 ± 1.17 (p=0.04). The ACB for those presenting with retention was low at 0.63 ± 0.59 and not significantly different from our general population. (p= 0.231).

With respect to prescribing practices, we found 5 patients were already on an antimuscarinic, which was oxybutynin in all cases, and 3 were on a B3 agonist at the time of referral. Of the 36 patients presenting with LUTS, 4 were started on an antimuscarinic and 5 were started on a B3 agonist. Age/frailty was cited as a reason to not start an antimuscarinic for 12 patients.

Anticoagulation

Hematuria was the most common reason for referral; therefore, we did further analysis of anticoagulation therapy in this population. We included aspirin, clopidogrel, warfarin and NOACs/DOACs. Over half of nonagenarians in this study were on some form of antiplatelet/anticoagulation therapy (Table 5). Of the 41 patients with hematuria, 32 (78.1%) were on anticoagulation therapy. Most commonly these patients were on aspirin (n=21, 51.2%), followed by warfarin (n=7, 17.1%), clopidogrel (n=5, 12.2%) and DOAC/NOAC (n=4, 9.8%). Only 5 of these patients were on some form of dual therapy (Table 5).

RESULTS

The specialty of urology is highly utilized by older adults. As the nonagenarian population in Canada grows, we need to be more prepared to manage these patients appropriately. Our study investigated the care needs of nonagenarians with urologic issues and their diagnostic and therapeutic outcomes. Not surprisingly, the only retrospective study comparing urologic hospitalizations in octogenarians and nonagenarians to other adults, Erkan et al. found the older adults had significantly more complications, length of hospital stay, need for readmission and mortality.[7]

According to Statistics Canada, one-third of people aged 85 and older live in collective dwellings, and this increased to two-thirds among centarians.[1] In our population only 14.3% of patients were living in collective dwellings. Furthermore, only 8.5% of patients had reported dementia. This is much less than expected according to the Canadian Study of Health and Aging, which found 1/3 of adults 85 and older living in community have dementia.[8] This highlights a possible referral bias within our population. Other studies have also demonstrated that nonagenarians undergoing elective surgery have lower overall comorbidity, especially diabetes, COPD and coronary artery disease.[9] This can be attributed to a combination of selection bias as well as these conditions tend to shorten life expectancy. A study looking at nonagenarians versus octogenarians using the NSQIP database from 2007 to 2012 demonstrated that the percentage of nonagenarians undergoing surgery has been increasing, and that despite this cohort having less

comorbidities than their octogenarian counterparts they had more morbidity and mortality following surgery than octogenarians.[9] This demonstrates that increased age alone, despite less comorbidities, makes surgical procedures riskier for nonagenarians. Surgery must be done with caution in nonagenarians even when carefully selected, taking into account their underlying changes in physiology.

With respect to surgical intervention, none of our patients underwent major abdominal surgery, which carries a risk of any complication of 19-56% in the general population.[10] Pridgeon et al in their study of 653 nonagenarians seen by Urology, only two patients had major abdominal surgery, which was a nephrectomy in both cases. Interestingly the mean length of stay was prolonged at 37 days following this surgery.[5] Overall they reported in-hospital mortality was 16% (4/25) versus 1.4% (1/71) for emergency and elective surgeries, respectively. Not including cystoscopy, TURBT and TURP were the most common surgeries in both studies. The complication rate of these procedures in the general public is lower than abdominal surgeries, but still noteworthy at 11% for TURBT and 10% for TURP.[10]

Multiple tools have been developed to predict morbidity and mortality in surgical patients. A review of 9 predictive tools in the elderly population all showed that older age is an independent predictor of mortality. At baseline one-year mortality for adults 90 years of age and older is 15-19%, whereas 1-year mortality after abdominal surgeries rises to 27-31%.[11-13] However, they also demonstrated that frailty is a better predictor of mortality and morbidity than age.[14] Frailty is defined as a decline in physiologic reserve leading to vulnerability to poor health outcomes from minor stressor events.[15] Frailty in patients undergoing surgery is associated with prolonged hospital stay, decline in functional status, and loss of independence.[16] There is no clear consensus on the best tool for measuring frailty to predict postoperative complications. A large urologic study comparing NSQIP frailty index, simplified frailty index and Risk Analysis Index for pre-operative risk assessment for common urologic procedures demonstrated the American Society of Anesthesiologists (ASA) classification system was a stronger model fit for predicting any, major and minor complications than the 3 frailty indices.[17]

Not surprisingly, presentations associated with urologic cancers made up a significant portion of referral in our study given increasing age is a risk factor for many urologic cancers. Bladder cancer (BCa) was the most commonly diagnosed malignancy. All patients presenting with gross hematuria were offered complete workup in accordance to guidelines, but treatment options were subjectively tailored based on patient factors. Treatment of BCa included TURBT in 13 out of 19 patients and BCG in 3 patients. A multicentre study of 123 nonagenarians with BCa found that 62% were pTa or pT1 tumours and 9 patients underwent radical cystectomy (RC) with ureterocutaneostomy. Interestingly, the overall survival (OS) of those 9 patients was only 5 months whereas those with pathology greater than or equal to pT2 tumours who did not receive RC had a slightly longer OS at 7 months. Again, ASA score was a significant predictor of OS. Leading to the suggestion that those with pT2 or greater tumours and ASA score of III and those with ASA IV have median survival of less than 10months and treatment should aim at palliation

and avoiding unnecessary hospital admissions. Whereas nonagenarians with an ASA score of II or pTa tumours survived for more than 2 years with 2/3 having no recurrence after TURBT, suggesting treatment is of benefit for this group.[18]

Conversely, PCa was less aggressively investigated and treated in our cohort. Elevated PSA and positive clinical examinations were not followed up with prostate biopsy, and ADT was initiated in only 6 patients. A recent study of 44 nonagenarians diagnosed with PCa found over half presented with metastatic disease with diagnosis made mainly from elevated PSA ordered for patients reporting bothersome LUTS.[19] During the study period 23 patients died, however the cause of death was PCa in only 8 men. ADT was offered to patients with metastatic cancer to mitigate symptoms from their malignancy. Current PCa guidelines do not recommend PSA screening in patient with life expectancy less than 10 years, which would typically include nonagenarians.[20] Treatment of organ defined disease is also recommended against given low cancer-specific mortality.[21] The International Society of Geriatric Oncology (SIOG) suggest management should be based on health status and patient preference as opposed to age. They recommend early introduction of palliative care, active surveillance or watchful waiting in localized PCa, and ADT therapy plus or minus combination with androgen receptor axis targeted therapy for metastatic PCa.[22]

Antithrombotic therapy is highly prevalent in the aging population for prevention and treatment of venous thromboembolism and cardiovascular disease and was used by 56.8% of our cohort. A Canadian research group studied the risk of hematuria related complications in patients on antithrombotic therapy.[23] They use of these medications, compared to non-use, was significantly associated with hematuria-related complications including emergency department visits, hospitalizations, and urologic procedures. Exposure to dabigatran had the lowest rate of complication, whereas rivaroxaban had the highest rate. Combination therapy of anti-platelet and anticoagulation therapy had significantly increased rates of complications. They also found patients taking antithrombotic therapy were more likely to receive a diagnosis of bladder cancer, with the thought that these medications unmask otherwise asymptomatic lesions. Although the consequence of thromboembolic events is much greater than the risk of hematuria, the presence of hematuria and its related complications may impact patient compliance to their antithrombotics, placing them at serious risk of heart attack or stroke.[23]

Fortunately the ACB score in this elderly cohort was relatively low as 76% of the cohort had an ACB of 0-1. ACB is a strong predictor of cognitive and physical impairment, associated with increased rate of falls, decline in cognitive function and memory, decline in activities of daily living and high mortality rates.[24] The Society for Urodynamics, Female Pelvic Medicine, and Urogenital Reconstruction (SUFU) released a white paper on anticholinergic medications and dementia risk in 2022.[25] In this white paper they highlight the use of overactive bladder anticholinergics is associated with increased risk of new-onset dementia, with studies reporting the number needed to harm is about 37.[25] A systematic review and meta-analysis reported the use of medications with anticholinergic effects has a 1.20-fold increase in risk of all-cause

dementia.[26] SUFU recommends the use of trospium, a quaternary amine that does not cross the blood brain barrier, intravesical Botulinum toxin, and mirabegron may be safer alternatives for OAB treatment.[25]

Many urologic surgeries are performed on an elective basis providing time for perioperative optimization of elderly and frail patients undergoing elective abdominal surgery using a multidisciplinary team consisting of surgery, anaesthesia and geriatrics. These multidisciplinary teams have demonstrated benefit with respect to shorter median length of stay, lower readmissions, and increased likelihood of discharge home with supports.[27] For example the Perioperative Optimization of Senior Health (POSH) Initiative use preoperative appointments focused on risk reduction through optimizing cognition, medications, comorbidities, mobility, functional status, nutrition, hydration, pain control and advanced care planning.[27] Enhanced recovery after surgery (ERAS) protocols also recommend preoperative optimization of elderly patients through pre-habilitation through physical therapy, psychological counselling and nutrition optimization in addition to Geriatrician evaluation and a comprehensive geriatric assessment.[28] The implementation of postoperative rehabilitation programs have also shown significant benefit, such as the Elder-Friendly Approaches to the Surgical Environment (EASE) protocol involving capacity re-alignment, interdisciplinary care, conditioning and transition optimization. A prospective study of two general surgery units in Canadian hospitals found a decrease in length of stay and a 19% decrease in major complications or death after applying the EASE principles.[29]

There are several limitations as this study was non-standardized due to the retrospective nature of this chart review. This is a single centre study with a small sample size that may lack external validation. Our patient screening method excluded an important population, nonagenarians admitted to urology from the emergency department. Furthermore, we lack a comparison group to observe any unique differences in managing nonagenarians compared to other older adults. However, this study is not intended to provide advice on appropriate treatment for this cohort, but rather to qualify the current state of practice to identify areas of high yield that request careful attention for the future of urology as the population ages. A prospective registry to observe these patients over time would be ideal for understanding the actual burden of urologic disease and care needs over time.

CONCLUSIONS

The most common reasons for urological referral of nonagenarians include hematuria and LUTS. The majority of nonagenarians are offered routine investigations, and variable rates of intervention for common benign and malignant urological diagnoses. Many patients accept and tolerate endoscopic interventions with few complications. However, nonagenarians possess unique physiologic changes of aging. An individualized patient-centred care approach is likely most appropriate, with judicious with of investigations and treatments, to minimize hospitalizations and harm.

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FIGURES AND TABLES

Table 1. Demographic information for nonagenarians (N=152)	
	n (%)
Mean age	92.3 (90-99)
Sex	
Male	117 (77.0)
Female	35 (23.0)
Residence	
Home	89 (58.6)
Assisted	32 (21.1)
Dependent	21 (13.8)
Unknown	10 (6.6)
Number of comorbidities	
0	1 (0.6)
1–5	81 (53.2)
6–10	59 (38.8)
>10	7 (4.6)
Unknown	4 (2.6)
Number of medications	
0	3 (2.0)
1–5	84 (55.6)
6–10	44 (29.1)
>10	20 (13.2)

Table 2. Referral source, reason for referral, and diagnosis given by urology	
	n (%)
Wait time (days)	73.52
Referral source	
Family physician	91 (60.0)
Specialist	19 (12.5)
Emergency	23 (15.1)
Inpatient	14 (9.2)
Unknown	5 (3.3)
Reason for referral	
Infection	8 (5.3)
Stone	6 (3.9)

Hematuria	43 (28.3)
Elevated PSA	11 (7.2)
Incontinence	7 (4.6)
Renal mass	4 (2.6)
LUTS	35 (23.0)
Retention	21 (13.8)
Other	17 (11.1)
Diagnosis	
Infection	11 (7.2)
Incontinence	19 (12.5)
BPH	33 (21.7)
OAB	3 (2.0)
Urolithiasis	9 (5.9)
Cancer	41 (27.0)
Phimosis	4 (2.6)
Radiation cystitis	3 (2.0)
Hydronephrosis	4 (2.6)
Benign workup	12 (7.9)
Other	13 (8.6)

BPH: benign prostatic hyperplasia; LUTS: lower urinary tract symptoms; OAB: overactive bladder; PSA: prostate-specific antigen

Table 3. Investigations, treatments, procedures and complications for nonagenarians seeking urologic care	
Investigation	**n (%)**
Blood work	23 (15.1)
PSA	24 (15.8)
Urine tests	22 (14.5)
Urine culture	11 (7.2)
Imaging	53 (34.9)
Uroflow/scan	37 (24.3)
Urodynamics	13 (8.6)
Cystoscopy	81 (53.3)
DRE	30 (19.7)
Prostate biopsy	0 (0.0)
None	13 (8.6)
Treatment	

Conservative management	73 (48.0)
Medications	58 (38.1)
Antibiotics	21 (13.8)
B3 agonist	7 (4.6)
5-alpha reductase inhibitor	9 (5.9)
Androgen deprivation	6 (3.9)
Alpha blocker	12 (7.9)
Other	15 (9.9)
Catheter	15 (9.9)
Surgical	40 (26.3)
Procedures	
TURBT	13
TURP	4
Ureteral stent	5
Evacuation of clots	5
Laser lithotripsy	3
ESWL	3
Circumcision/dorsal slit	3
Bulkamid injection	1
Removal of AUS	1
Excision of urethral caruncle	1
Penectomy	1
Anesthetic	
Local	9
Spinal	2
Sedation	8
General	21
Complications	8

AUS: artificial urinary sphincter; DRE: digital rectal exam; ESWL: extracorporeal shock wave lithotripsy; PSA: prostate-specific antigen; TURBT: transurethral resection of bladder tumor; TURP: transurethral resection of the prostate.

Table 4. Anticholinergic burden as calculated using the Anticholinergic Cognitive Burden Scale (ACB) using medication lists at time of consultation	
ACB	**n (%)**
0	68 (45.0)
1	47 (31.1)
2	15 (9.9)
3	16 (10.6)
4	3 (2.0)
5	2 (1.3)

Table 5. Patients presenting with hematuria, antithrombotic therapy, and the types of antithrombotic therapy	
	n (%)
Total with hematuria	43 (27.9)
Total on anticoagulation	83 (56.8)
Hematuria and on anticoagulation	32 (78.0)
Aspirin	21 (51.2)
Clopidogrel	5 (12.2)
Warfarin	7 (17.0)
DOAC/NOAC	4 (9.8)
Dual therapy	5 (12.2)

DOAC/NOAC: directly acting oral anticoagulants/newer anticoagulants, novel oral anticoagulants.