

Is Ultrasound the Urologist's Stethoscope in the Outpatient Clinic?

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Abstract

Ultrasound is a non-invasive diagnostic imaging modality that has become the urologist's stethoscope in the outpatient clinic for diagnosis and monitoring of various urological pathologies. **Objectives:** Check if office ultrasound is beneficial in the outpatient clinic, helpful in the management, affected by the economic crisis, and determine in which condition it is sufficient. **Materials and Methods:** Between 2012 and 2022, one thousand files were prospectively collected randomly. Many objectives were chosen to evaluate the impact of the economic crisis on the use of ultrasound, identify the clinical conditions where ultrasound is beneficial, determine the conditions where ultrasound was sufficient, and determine if ultrasound findings were helpful for management. **Results:** The economic crisis did not impact the use of ultrasound, when the chief complaint was flank pain, 56.7% had positive findings. In 54%, ultrasound was helpful to avoid the need for further imaging, and in 93.5%, ultrasound was helpful in the management of patients. When the chief complaint was LUTS, 25.6% had positive findings while 82.9% did not require further imaging, in 78.6%, ultrasound was helpful in the management. In the case of hematuria, 60.7% had positive findings, 20% did not need further imaging, and 81% of ultrasounds were helpful in the management. When patients present with urgency 31% had positive findings, 93.7% did not require more imaging and 76% of ultrasounds were helpful in management. In the case of dysuria as the chief complaint, 35.8% had positive findings, 77.7% did not need more imaging, and helpful in the management of 62.8%. **Conclusion:** Ultrasound is a valuable cost-effective tool in the outpatient clinic urology clinic for diagnosing and monitoring. It is safe, painless, and can be repeated easily which makes it the precious Urologist's stethoscope.

Keywords

Office Ultrasound, Hematuria, LUTS, Dysuria, Urgency

1. Introduction

Ultrasound (US) is a non-invasive diagnostic imaging modality that has become a reliable tool in the outpatient urology clinic for diagnosing and monitoring various urological conditions [1]. Compared to other imaging modalities, ultrasound has the advantage of being entirely safe, with no radiation exposure or need for contrast, making it a safer option for patients [2]. Additionally, it is a quick and painless exam, making it a preferred choice for patients, and can be repeated easily. With short training, urologists can achieve acceptable accuracy in identifying the most common pathologies scanned by ultrasound, helping them make a quick diagnosis and properly manage patients [3]. In addition, urologists can use ultrasound to follow up with their patients after management to check their post-void residue, degree of hydronephrosis after medical expulsive therapy, presence of fragments after ESWL or other invasive therapies, and recurrent bladder lesions after resection to determine management, such as cystoscopy or TURBT. This article explores the impact of the financial crisis as well on the use of ultrasound in the outpatient clinic.

2. Objectives

This study aims to evaluate the impact of the economic crisis on the use of ultrasound in outpatient clinics and has several objectives. Firstly, the study aims to assess how the economic crisis has affected the utilization of ultrasound in outpatient clinics. This will involve analyzing trends in the frequency of ultrasound usage and changes in the types of patients and clinical conditions for which ultrasound is ordered.

Secondly, the study aims to identify clinical conditions in outpatient clinics where ultrasound is particularly beneficial. Ultrasound can be used to monitor a wide range of conditions, including renal and bladder conditions and stone disease, regardless of the initial presentation.

Thirdly, the study aims to determine the conditions where ultrasound is a helpful management tool. By understanding which conditions benefit most from ultrasound-guided procedures, healthcare providers can improve the quality and safety of patient care.

Finally, the study aims to identify the conditions where ultrasound is sufficient as a diagnostic tool. This will help healthcare providers avoid unnecessary testing and reduce costs.

3. Materials and Methods

Between 2013 and 2022, we prospectively collected data from referrals to a single

center. One thousand files were randomly chosen by the secretary of the outpatient urology clinic and evaluated by the urologist and the chief resident of the department. These files were equally divided into two periods: before and after the economic crisis that began in September 2019 (**Table 1**). All of the ultrasounds were performed by one trained urologist using the Mindray equipped with two probes: 3.5 and 6 MHz. The kidneys and bladder were scanned in supine and oblique positions.

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Review Board at Sahel General Hospital, and the study was assigned the reference number 3/2022. All participants provided written informed consent prior to participation in the study.

4. Inclusion and Exclusion Criteria

Inclusion criteria were patients presenting with acute flank pain, gross hematuria, urinary storage symptoms, scrotal enlargement, UTI, LUTS, and urinary retention.

Exclusion criteria were patients presenting with muscular pain, UTI, ED, infertility, hypospadias, undescended testis, high PSA, varicocele, torsion-detorsion, and spermatocele.

Table 1. Patients characteristics with US.

Age	0 - 15 y	45
	16 - 30 y	95
	31 - 45 y	173
	41 - 60 y	168
	>60	177
Sex	Male:	417
	Female:	242
Co-morbidities	Total	322/659
	HTA	134
	D.M	84
	CAD	27
	Stone former	27
	Depression	19

5. Results

After excluding files that did not match the inclusion criteria, 695 patients underwent ultrasound in the urology outpatient clinic on their first visit. We ana-

lyzed multiple variables to answer the objectives mentioned above (**Table 2**).

5.1. Impact of the Economic Crisis

The impact of the economic crisis on the use of ultrasound before and after 2019 was not significant when comparing chief complaints. The use of ultrasound was similar between the two periods, with 316 and 343 ultrasounds performed after and before 2019, respectively.

5.2. Flank Pain

In an outpatient clinic, flank pain is commonly evaluated using ultrasound. This is because ultrasound is a noninvasive and inexpensive imaging modality that does not involve radiation exposure, can be repeated as needed, and can be used in emergency settings in case of flank pain [4]. In this study that included 266 patients with flank pain, 151 (56.7%) had positive ultrasound findings. In 54% of cases, ultrasound helped to avoid the need for further imaging, and in 93.5% of cases, ultrasound was helpful in the management of patients.

5.3. LUTS

LUTS is a common symptom that can be caused by various underlying conditions, such as Benign Prostate hyperplasia, urinary tract infections, bladder disorders, and other urological conditions [5]. In our study which included 117 patients with urinary LUTS, ultrasound was used to evaluate the diagnosis. 30 (25.6%) had positive ultrasound findings, while 97 (82.9%) did not require further imaging. Ultrasound was helpful in the management of 92 cases (78.6%).

5.4. Hematuria

Hematuria can be a symptom of various underlying conditions, such as infections, malignancy, kidney stones, and other urological conditions. Ultrasound is a non-invasive and safe imaging modality that can be used to evaluate the urinary tract and identify potential causes of hematuria. An accurate diagnosis of the underlying cause is essential in guiding appropriate treatment [6].

In our study, 79 patients presented with hematuria, and 48 (60.75%) had positive

Table 2. Results.

Chief complaint	Number	Positive findings	%	P-value	No need for more imaging		US Helpful in management			
					%	P-value	%	P-value	%	P-value
Flank	266	151	56.7	0.075	78	29.3	0.002	201	75.5	0.076
Hematuria	79	48	60.7	0.82	16	20	0.73	64	81	0.74
LUTS	117	30	25.6	0.059	97	82.9	0.002	92	78.6	0.173
Urgency	63	41	65.7	0.2	45	71.4	0.001	48	76	0.091
Dysuria	148	53	35.8	0.005	115	77.7	0.016	93	62.8	0.007

ultrasound findings. Ultrasound was helpful in directing the management of 64 cases (81%), while 16 (33%) did not require further imaging.

Out of 87 patients presenting with gross hematuria in our study, 20 were diagnosed with bladder tumors using the US (22.9%).

5.5. Urgency

Urgency, or the sudden need to urinate, is a common symptom that can be caused by various underlying conditions, such as urinary tract infections, overactive bladder syndrome, and interstitial cystitis. In our study that included patients with urgency as their initial presentation in a clinic, ultrasound was used to evaluate the frequency of positive findings. Of the 48 patients, 15 (31%) had positive ultrasound findings ($P = 0.29$), 45 (93.7%) did not require further imaging ($P < 0.001$), and ultrasound was helpful in the management of all cases (76%, $P = 0.09$).

5.6. Dysuria

Dysuria is a symptom that can be caused by various underlying conditions, such as urinary tract infections, sexually transmitted infections, bladder inflammation, interstitial cystitis, kidney or ureteral stones, and certain types of cancer. In our study which included 148 clinic patients with dysuria, ultrasound was used to evaluate the frequency of positive findings. Of the 148 patients, 53 (35.8%) had a positive ultrasound finding. In 77.7% of cases, further imaging was not necessary, and ultrasound was helpful in the management of 93 cases (62.8%). These findings suggest that ultrasound can be a valuable tool in managing dysuria, as it can potentially avoid the need for unnecessary imaging and aid in treatment decision-making.

6. Discussion

Office ultrasonography is an increasingly popular diagnostic imaging modality in urology clinics due to its numerous advantages even for children [7]. It is a non-invasive and painless option that allows for rapid and repeatable evaluation of urologic complaints, making it convenient for patients. Additionally, ultrasonography aids in prompt diagnosis, avoiding delays in treatment, and augmenting physical exams [1]. As a result, it has become the preferred diagnostic modality for many urologic emergencies, such as scrotal trauma [8].

Compared to CT or MRI, ultrasound is completely safe and does not expose patients to radiation or require contrast agents. This makes it a safer option for patients, particularly those presenting with signs of malignancy, such as hematuria, especially in the case of microscopic hematuria [9].

One of the objectives of our study was to evaluate the influence of the economic downturn on the utilization of ultrasound in the ambulatory urological setting and determine the clinical indications where ultrasound confers benefits.

Our findings indicate that the impact of the financial crisis on the use of ul-

trasound was not statistically significant, as the number of ultrasounds performed remained consistent between the two time periods. Specifically, 316 ultrasounds were conducted after 2019 compared to 343 ultrasounds before 2019, suggesting that ultrasound remains a prevalent, economical, and efficient diagnostic imaging modality in urology outpatient clinics. This is likely due to its non-invasiveness, which makes it the preferred modality regardless of patient age [10]. In addition, it has clearly reduced the number of clinical consultations and assisted in treatment planning.

Although subject to variability, urologists, including trainees, with short training can achieve acceptable accuracy in identifying the most common pathologies scanned by ultrasound, enabling them to quickly diagnose and properly manage patients [3].

The use of ultrasound in emergency departments has been shown to shorten the length of stay for patients presenting with flank pain [11]. In addition, Ultrasound can accurately detect hydronephrosis and kidney or urinary tract stones, as well as identify the location of stones in the UPJ and UVJ if the bladder is full, which can eliminate the need for further imaging, such as CT scans, thereby reducing radiation exposure, time, and cost [12]. In cases where acute flank pain is accompanied by hydronephrosis, medical expulsive therapy can be initiated, and the degree of hydronephrosis can be monitored throughout and after treatment, whether it is medical, ESWL, or surgical.

Our study revealed that urologists can use ultrasound in the majority of patients presenting with flank pain, and more than half of these patients had positive findings. Ultrasound was helpful in guiding the management of over 93% of patients, reducing the cost and the need for further visits when findings were normal.

Furthermore, ultrasound can detect other renal pathologies, including UPJ obstruction, kidney mass, angiomyolipoma, adrenal mass, and complex cysts.

Even though patients presenting with lower urinary tract symptoms (LUTSs) have low positive findings, ultrasound can still aid in the management of over 78% of patients when done in the outpatient clinic by a urologist, thereby avoiding the need for further imaging and reducing the risk of radiation exposure, cost, and follow-up visits.

In the case of benign prostatic hyperplasia (BPH) and LUTS, ultrasound can be used to assess intravesical prostatic protrusion (IPP) and Detrusor wall thickness, measure prostate volume, and detect the presence of diverticulae. Franco *et al.* found that these two parameters can accurately diagnose bladder prostatic obstruction (BPO) in patients with LUTS due to BPH [13], while Kalkani *et al.* showed that increased IPP values are associated with a lower response to alpha-receptor-specific management [14]. In addition, ultrasound can be used to measure the post-void residual urine volume (PVR) before prescribing anticholinergics and to assess the success of alpha-blockers in reducing this residual urine. However, some studies have found that ultrasound is not reliable for measuring

PVR compared to the volume of urine drained by a urethral catheter, as Abdel wahab *et al.* demonstrated in their prospective study on 45 men with LUTS/BPH [15].

For patients exhibiting the symptom of hematuria, there is a growing need for clinical ultrasound as a diagnostic modality. When examined fully, positive Rosenkilde *et al.* suggested the possibility of ultrasound to replace follow-up cystoscopy to check for recurrence and found that this can be used in low-grade tumors only and noted, when examined fully, findings indicating bladder tumors were present in more than half of the patients [16].

Most of our patients underwent further imaging, which is consistent with the findings of other authors. In Australia, Ooi *et al.* conducted a study on the role of proper assessment of patients using ultrasound on patients presenting for the first time with hematuria and demonstrated the efficiency in guiding the proper management and referral [6]. In the era of computed tomography urography (CTU), some authors evaluated the role of ultrasound in patients presenting with gross hematuria and concluded that the US adds little benefit in this setting and should not be used [17]. In evaluating the proper approach to patients with hematuria, Willis and Tewelde confirmed the superiority of CTU [18]. In a large study comparing renal and bladder ultrasound to CTU in patients presenting with microscopic hematuria at identifying urinary tract malignancy, Wei Shen Tan *et al.* concluded that the sensitivity of RBUS was lower than CTU for the detection of bladder cancer (both < 85%) and that cystoscopy has higher accuracy [19]. Smith *et al.* published their 20-year experience in a community hospital in the evaluation of asymptomatic hematuria by renal ultrasound to detect upper urinary tract malignancy. Ultrasound had 100% sensitivity in detecting renal cell carcinoma and upper tract urothelial malignancy. They concluded that Ultrasonography is an appropriate modality for upper tract imaging in the initial evaluation of patients with asymptomatic microscopic hematuria [20].

Ultrasound has changed our management regarding patients presenting with hematuria with a bladder tumor seen on ultrasound which has shifted our decision to perform direct TURBT instead of a previous diagnostic cystoscopy.

Dysuria is one of the primary chief complaints that prompt patients to seek consultation. It can be caused by various medical conditions, including urinary tract infection, interstitial cystitis, or bladder cancer. In this study, ultrasound was found to be helpful in managing dysuria in more than half of the cases.

Ultrasound goes beyond its primary function as a diagnostic tool, as it has also proven to be a valuable imaging technique for follow-up purposes. This includes patients who have a history of kidney stones, kidney cysts, or benign masses, as well as for post-treatment imaging after surgical or medical removal of stones. Ultrasound can be used alone or in conjunction with KUB [21] [22].

However, some limitations were noted in this study. Firstly, it is a retrospective study with prospectively collected data. Secondly, it was performed by a single trained urologist, and the results were not confirmed by another radiologist

or urologist. Thirdly, due to the economic crisis and COVID-19 lockdown, more than half of the patients did not show up for the follow-up, which can affect the results of positive findings, given that sonography has its inherent limitation as a sole test.

7. Conclusions

In conclusion, ultrasound is a valuable tool in the outpatient urology clinic for diagnosing and monitoring various urological conditions. It is a safe, quick, and painless exam that can be repeated easily, making it a preferred choice for patients and an Urologist's precious stethoscope.

We should remember that the ultrasound is a "double sword". Being operator dependent, the possibility of misdiagnosis is higher in non-well-trained physicians. Any suspicious finding(s) should be confirmed by an imaging, or another ultrasound performed by a certified radiologist.

Although further testing, such as computed tomography (CT) or magnetic resonance imaging (MRI), may be necessary to confirm the diagnosis and provide more detailed information about the extent and severity of the condition. Ultrasound has been able to answer urologists' on-spot questions regarding the future management of patients and thus can be considered an urologist stethoscope in the outpatient clinic.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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