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Contribution of Doppler Ultrasound in the Evaluation of Scrotal Pain and Swelling

Contribution de l'échographie doppler à l'évaluation des grosses bourses et des bourses douloureuses

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ABSTRACT

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Mots clés : Grosse bourse, Douleur scrotale, Echographie Doppler, Yaoundé, Cameroun

Introduction. Scrotal swelling and pain are frequently encountered in clinical practice. Although in some patients, history and physical examination are adequate to reach a diagnosis, yet in a large percentage of patients, additional studies are required for complete evaluation of their symptoms. Color Doppler examination of scrotum has been demonstrated to have significant impact on diagnosis of scrotal swelling. Our study was aimed to evaluate how Doppler Ultrasound (DU) can be effective in the evaluation of scrotal pain and swelling, in characterizing, and its management. **Methodology.** This was a cross-sectional descriptive study on patient who presented on consultation with acute scrotal pain, swelling. The study was carried out in Yaounde at the Yaounde Central Hospital and the Yaounde Gyneco Obstetric and Pediatric Hospital in the Urology and Radiology departments. The study lasted seven 7 months. **Results.** One hundred and fifty-two (152) patients were enrolled. Their ages ranged from 4 to 75 years with a mean age of 34.83 ± 13.78 years with the most occurring age group between 15-30 age with $n=56$ (36.08%). The Cohen kappa correlation test between clinical findings and DU findings showed the following results: almost perfect agreement for testicular torsion (0.959) and epididymo-orchitis (0.93); substantial agreement for varicocele (0.788) and fair agreement for normal testes (0.597). DU had a sensitivity (Se) of 92.9% and specificity (Sp) of 100% in the diagnosis of testicular torsion. The values for other pathologies were epididymo-orchitis (Se 100%, Sp 99.3%); varicocele (Se 92.9%, Sp 96%); normal testes (Se 68.6%, Sp 96%); microlithiasis and epididymal cyst (Se 100% and Sp 100%). **Conclusion.** Doppler Ultrasound is effective in the evaluation of scrotal pain and swelling.

RÉSUMÉ

Introduction. La tuméfaction et la douleur du scrotum représentent un motif de consultation fréquent en urologie. L'objectif de ce travail était d'évaluer l'efficacité de l'échographie Doppler dans l'exploration de la douleur et la tuméfaction scrotales. **Méthodologie:** Il s'agissait d'une étude transversale descriptive réalisée dans deux hôpitaux universitaires de Yaoundé au Cameroun. Elle portait sur tous les patients qui présentaient une douleur scrotale et une tuméfaction. Les données ont été collectées à l'aide d'un formulaire de collecte de données préétabli. L'analyse statistique a été effectuée à l'aide de la version 20 de SPSS et de la version 3.54 d'Epi-Info pour Windows. Le coefficient de corrélation, la sensibilité et la spécificité de l'échographie doppler ont été calculées pour les principales pathologies. **Résultats.** Nous avons recruté 152 patients. Leur âge variait entre 4 et 75. Tous les patients se plaignaient de douleur scrotale alors que 78 (51,30%) présentaient une tuméfaction scrotale. Le diagnostic clinique le plus fréquent était les varicocèles $n = 119$ (78,3%). Les diagnostics échographiques les plus fréquents étaient : hydrocèle $n = 150$ (98,70%) ; varicocèles $n = 127$ (83,60%) et microlithiases épидидymaires $n = 39$ (25,70%). Le test de corrélation de Cohen kappa a montré une bonne concordance entre les résultats cliniques et les résultats de l'échographie Doppler. La sensibilité et la spécificité échographique étaient excellentes dans la détection des torsions testiculaires, des orchi-épididymites, des varicocèles, des microlithiases testiculaires, des hydrocèles, et des kystes épидидymaires. **Conclusion.** L'échographie Doppler est efficace dans l'évaluation de la douleur et de la tuméfaction scrotale.

INTRODUCTION

Scrotal pathology is common in both children and adults. It concerns nearly 200 reasons for consultation in Switzerland[1]. In Mali, it constitutes 5.5% of urological

consultations[2]. Its etiologies are numerous. The spectrum of pathologies involving the scrotum and its contents extends from benign lesions where you just need to reassure the patient to severe lesions, whose

management must be carried out for some in extreme urgency. The acute scrotum is a medical emergency defined as scrotal pain, swelling, and redness of acute onset [3]. In adults acute epididymo-orchitis is the most common cause of an acute scrotum. In children torsion of a testicular appendix or testicle are most common causes[4]

Scrotal swelling and pain are frequently encountered in clinical practice. Although in some patients, history and physical examination are adequate to reach a diagnosis, yet in a large percentage of patients, additional studies are required for complete evaluation of their symptoms. The clinical examination is often misleading or non-specific. Patients who present with acute onset of scrotal pain pose a diagnostic dilemma for the clinician. Traditionally, early exploration has been advocated. However, this may result in numerous needless operations, since it has been estimated that almost 80% of acute scrotal processes are inflammatory in nature[5].

The ability to confidently establish a surgical versus a nonsurgical diagnosis for acute scrotal pain is important. The benefits of early surgery for testicular salvage in ischemic disease, primarily torsion of the testis, are well-known; but must be balanced against the costs of operating unnecessarily on a large number of patients with nonsurgical disease, primarily acute epididymo-orchitis[6].

There is a wide over-lap of symptoms and signs of scrotal diseases, and because of this, none has a pathognomonic presentation. It is therefore difficult to differentiate these conditions on clinical grounds. [7].

Ultrasonography is an essential imaging modality in diagnosing testicular and scrotal pathology, as it provides fine anatomical details of the testicle and surrounding structures and evaluates vascular perfusion in real time. Clinical examination often yields nonspecific signs and symptoms such as scrotal pain, swelling or a palpable scrotal mass. Ultrasonography is able to identify and characterize intra-testicular or extra-testicular lesions and is often able to distinguish between benign or malignant lesions as well as identify conditions that require emergent surgical intervention. In addition, ultrasonography is a safe, relatively inexpensive, and readily available imaging modality that does not require ionizing radiation[8].

Color Doppler examination of scrotum has been demonstrated to have significant impact on diagnosis of scrotal swellings. Scrotal swellings can be acute painful swellings like Testicular Torsion, Epididymo-orchitis, Testicular Trauma, etc. or chronic swellings like varicocele, hydrocele, epididymal cysts, spermatocele, intratesticular cysts etc. The main indication for color Doppler ultrasound (which can reveal scrotal blood flow) is assessment of acute scrotal swelling especially in differential diagnosis of testicular torsion and epididymo-orchitis[9].

In a study assessing role of ultrasound in emergency setting it was able to differentiate between emergent surgical and non-surgical cases of acute scrotum in up to 84% of cases. Hence its use is proposed for triage of patients with acute scrotal pain in emergency department[10]. The aim of the study was to evaluate the

effectiveness of Doppler Ultrasound in the evaluation of scrotal pain and swelling, and how it characterizes scrotal swelling and pain and permit its management.

MATERIALS AND METHODS

It was a cross-sectional descriptive study carried out in two University teaching hospitals in Yaoundé. Study was carried on all patient who presented on consultation with acute scrotal pain, swelling and. Also files of patients received in the emergency and consultation with scrotal pain, swelling and was studied. After the patient agreed to take part in the study, the history of presenting complain was taken, a thorough systemic review and also a physical examination was made, after the clinical examination of the patient he was asked an imaging workup, which consisted of a Doppler ultrasound imaging. The Doppler ultrasound examination was done by a radiology physician. A specific form designed for this study was used to collect the patient identification, clinical examination data and the data given by the Doppler ultrasound imaging. After the Doppler ultrasound was made the data was collected and the diagnosis was made. Data was collected using a pre-established data collection form which was filled personally. Once this was done, the data was entered with the help of a statistician into statistical software's for integration and analysis, the Epi-Info version 3.5 software, Statistical analysis was carried out using SPSS version 20, and Epi-Info version 3.5 for windows. The results are presented in the form of tables, figures, mean. Results are discussed, conclusions drawn and recommendations made.

RESULTS

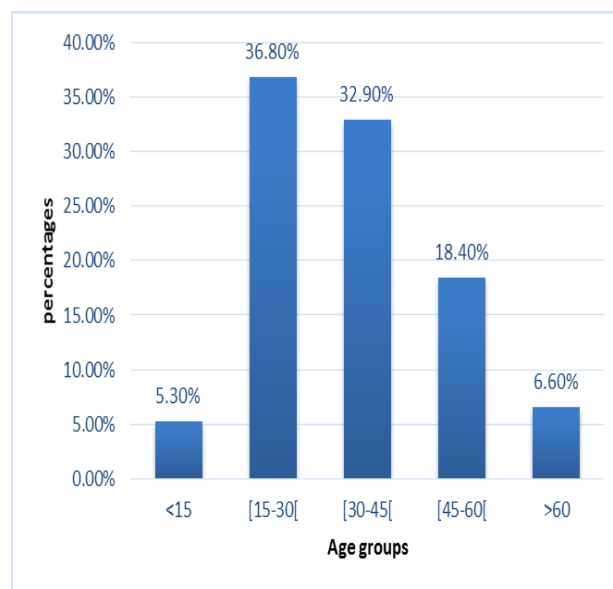


Figure 1: Distribution according to age group.

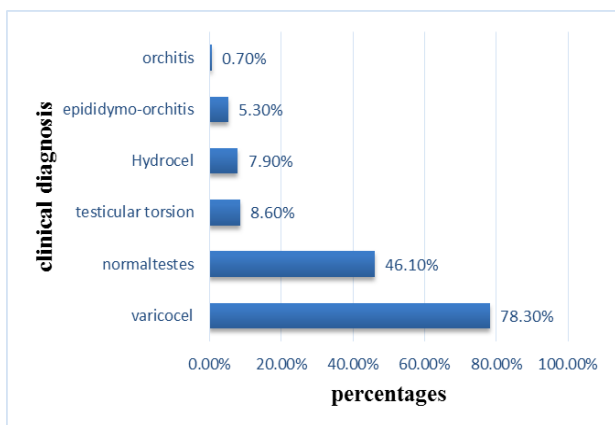


Figure 2: distribution of common pathologies on clinical diagnosis.

Table 1: comparison between clinical findings and DU findings.

Diseases	Clinical findings		Ultrasound findings	
	N	%	N	%
Hydrocele	12	7.90%	150	98.70%
Varicocele	119	78.30%	127	83.60%
Normal testes	70	46.10%	56	36.80%
Testicular torsion	13	8.60%	14	9.20%
Epididymo-orchitis	8	5.30%	7	4.60%
Orchitis	1	0.70%	3	2.00%
Cyst	0	-	11	7.20%
Epididymal microlithiasis	0	-	39	25.70%

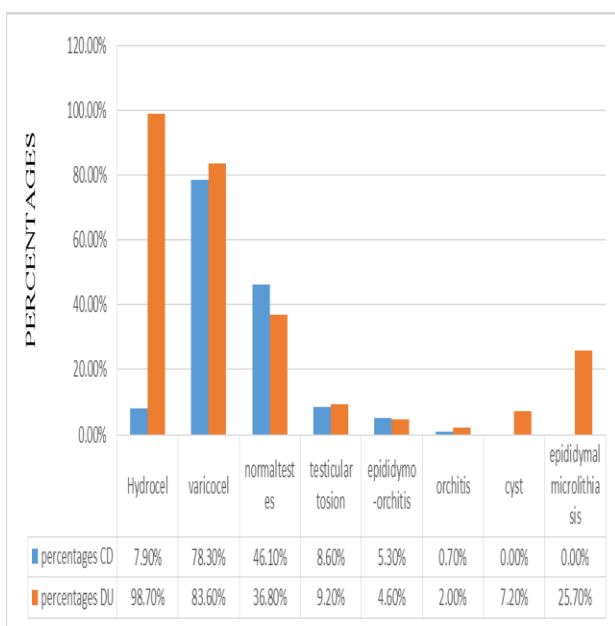


Figure 3: comparison between clinical findings and Doppler ultrasound findings.

Table 2: Representation of kappa value.

Variables	Ultrasound comparison			Kappa	P-value
	Positive	Negative	Total		
Testicular torsion					
Positive	13 (100)	0 (0)	13 (8.6)	0.959	0.000
Non	1 (0.7)	138 (99.3)	139 (91.4)		
Epididymo-orchitis					
positive	7 (87.5)	1 (12.5)	8 (5.3)	0.93	0.000
Non	0 (0)	144 (100)	144 (94.7)		
orchitis					
positive	0 (0)	1 (100)	1 (0.7)	-0.01	0.980
Non	3 (2)	148 (98)	151 (99.3)		
Varicocele					
Positive	118 (99.2)	1 (0.8)	119 (78.3)	0.788	0.000
Non	9 (27.3)	24 (72.7)	33 (21.7)		
Normal testes					
positive	48 (85.7)	8 (14.3)	56 (36.8)	0.597	0.000
Non	22 (22.9)	74 (77.1)	96 (63.2)		

Sensitivity and Specificity

We had a great sensitivity of Doppler Ultrasonography (DU) for testicular torsion, a very high specificity, a very high positive predictive value and a very high negative predictive value. According to the epididymo-orchitis, there was a great sensitivity of DU, a very high specificity, a very high positive predictive value and a very high negative predictive value. Great sensitivity of DU for orchitis, a very high specificity, a very high positive predictive value and a very high negative predictive value. Great sensitivity of DU for varicocele, a very high specificity, a very high positive predictive value and a very high negative predictive value. There was a great sensitivity of DU for normal testes, a very high specificity, a very high positive predictive value and a very high negative predictive value. Also, the great sensitivity of DU for microlithiasis, a very high specificity, a very low positive predictive value and a very high negative predictive value. And a great sensitivity of DU for cyst, a very high specificity, a very high positive predictive value and a very high negative predictive value.

Table 3: P-value for Doppler ultrasound parameters and the Doppler ultrasound findings.

	Positive	Negative	Total	OR (IC 95%)	P-value
DU findings	N	N	N		
Reversal flow in Valsalva manoeuvre					
Positive	198	3	201	3333 (549.66-22982)	0.000
Negative	2	101	103		
Whirlpool appearance					
Positive	14	1	15	-	0.000
Negative	-	289	289		
No flow					
Positive	14	-	14	-	0.000
Negative	-	290	290		
Calcification					
Positive	3	2	5	43.35 (5.58-378.4)	0.000
Negative	10	289	299		
Anechogenic					
Positive	256	7	263	70.53 (26.04-195.09)	0.000
Negative	14	27	41		
Hypervascularity					
Positive	11	10	21	-	0.000
Negative	-	283	283		
Epididymal size increased					
Positive	199	22	221	741.73 (130.28-15040)	0.000
Negative	1	82	83		
Heterogenous echostructure					
Positive	9	25	34	48.24 (10.5-333)	0.000
Negative	2	268	270		

DISCUSSION

Limits of the Study

Being the first study of the kind in Yaounde, there was limitation in terms of patients who live in remote areas some not having means to meet up with their appointment with the physician.

Patients records are not well nor correctly established in urologic services and some of the patients are directly taken to surgical wards in case of suspicion of testicular torsion.

Another limitation was the fact that Doppler ultrasound was not systematically ask to patient with scrotal pathologies by some physicians in remote areas making the patient reluctant to make Doppler ultrasound when it is asked for by a urologic specialist not able to make it with the cost.

The relationship between socio-demographic parameters and frequency of occurrence of disease was not established because of the short duration of the study and scarcity of some pathologies at the ultrasound and consultation unit which gave limited information for the establishment of cause effect and relationship.

The age range in our study was from 4 to 75 years, mean age was 34.83±13.78 years, the most occurring age group being the 15-30 age group, which was in concordance with that of Singh and al, with mean age of 35.25±12.93 and the most occurring age group was 30-40 years and also which was closed to that of Ibrahim and al, with mean age 39.12±11.89 years and most occurring age group being 25-44 years and closed to that of Khan and al with mean age 32.1 years ranging from 12 to 75 years and most occurring age group 21 to 30 years[9,11,12], and different from that of Kiguli and al, showing mean age at 31.2 years most occurring age group being 19-29 years[7], this can be explain by the fact the mean age group in our studies are exposed to hard work, stress. And the most occurring age groups in our exposed to promiscuity and also the variation of temperatures in this areas affect scrotal anatomies and exposes them to scrotal pathologies. This also shows us that the most affected population with scrotal pathologies is the mid adult hood stage of life even though others socio-demographic features are not explained.

Complaints

Almost all our patients came with scrotal pain and irradiation n=152(100%) and swelling n=78(51.30%) which was similar to that of Subramani and al with scrotal pain 100% and scrotal swelling 100% and closed to that of Yagil and al, with scrotal pain 89% and scrotal swelling 40%. And also closed to that of D'Andrea and al with scrotal pain 76.4% and scrotal swelling 19%[13,14,15]and different from that of Ibrahim and al, which had as presenting complain mostly infertility 54.8% and scrotal pain 21.7% and also different from that of Roth and al with dysuria 36.7% [11,16],

This can be explain by the limited time of our study and also the fact that some patient from some religious believes are reluctant to come for consultation. And also results differ from other authors because majority of the studies from the literature review were carried out on the Hindou race with their religious believes, feeding habits and mode of life, and some patients stay at home taking traditional medication allowing the symptoms to progress before coming to the hospital.

Clinical findings

In our studies the main clinical findings were varicocele 78.3% normal testes in at least one side 46.10%, unilateral testicular torsion 8.60%, and hydrocele 5.30%. which was closed to that of Rasool and al with hydrocele 55.5%, varicocele 22.9%, epididymo-orchitis 16.5% and also closed to the findings of Roth and al with the first being hydrocele 16%, varicocele 14%, testicular torsion 8%,[10,16]. But in discordance with that of Subramani and al, with epididymo-orchitis 45.71%, epididymitis 14.29%, pyocele 14.29%,[13]

This can be explain by the fact there is a high risk of ascending infections in some of the areas where the authors carried out their research, while in our study the occurrence of varicocele may be explained by duration of study with limited frequency of consultation to health care by patient and also the impaired drainage of blood from

spermatic cord, and also its gives us that not all lesions can be depicted by the physician only physical exam since the innermost structures of the scrotum are found under the skin and hence the eye cannot see them hence proving that the clinical diagnosis alone is not efficient in taking a decision on the diagnosis of scrotal pathologies

DU findings

In our study the main DU findings were being hydrocele 98.70%, varicocele 83.60%, at least a unilateral normal testes 36.80%, epididymal microlithiasis 25.70%, testicular torsion 9.20%, epididymal cyst 7.20% which was close to that of Ibrahim and al, with 33.13% varicocele, 26.96% hydrocele, normal testes 10.43%, epididymo-orchitis 6.96%, epididymal cyst 4.34% and TT 3.48% [17]. And great difference with that of Singh and al with epididymal cyst 45%, hydrocele 35%, epididymo-orchitis 30% varicocele 20% and TT 7.5%, also slightly different from that of Yagil and al with hydrocele 50%, epididymitis 29%, orchitis 19%, varicocele 13% and TT 13%, and was different from that of Rizvi and al, with epididymo-orchitis 37.7%, hydrocele 24.6%, varicocele 13.11%, testicular torsion 3.27% [9,18,19].

This can be due to the fact that hydrocele is a reactive process for many testicular swelling and pain hence being a serous fluid occurring in inflammatory and sometimes idiopathic processes its normal for it to be the most common and associated findings in all the ultrasound findings. These results also helped us to see how DU can describes a scrotal lesion with a high degree of accuracy thus completing he information from clinical findings and helping in a proper management of scrotal lesions with great confidence

Comparison between clinical findings and DU

In our study clinical findings and DU findings with hydrocele being de most DU findings 98.70%, varicocele being second 83.60%, normal testicular content 36.80%, TT 9.20% while clinical findings were predominantly varicocele 78.30%, normal testes 46.10%, TT 8.60% and hydrocele 7.90%. Which was slightly different from that of Singh and al with clinical findings showing epididymo-orchitis 25%, varicocele 17.5%, TT 15%, epididymal cyst 10% and hydrocele 7.5%. and on DU epididymal cyst 45%, hydrocele 35%, epididymo-orchitis 30%, varicocele 20%, and TT 7.5% [9].

As shown on table 2, the correlation between clinical finding and DU was measured with the Cohen kappa test which show significant statistical correlation (there is near perfect agreement) between clinical diagnosis and DU for the diagnosis of TT and epididymo-orchitis with values of kappa 0.959 and 0.93 respectively. Also significant statistical correlation (substantial agreement) between clinical diagnosis and DU for the diagnosis of varicocele with a Kappa value of 0.788. Also a kappa value of 0.597 show a fair agreement clinical diagnosis and DU for the diagnosis of normal testes and there is no agreement between clinical diagnosis and DU for the diagnosis of orchitis

These results explain the fact that for every time a lesion was suspected or seen on clinical bases it was confirmed

on DU and for the lesion that could not be seen on clinical bases they were depicted by Doppler ultrasound. And thus has a high degree of accuracy in diagnosing testicular pathologies.

Sensitivity and Specificity

The table 3 shows that DU has a sensitivity of 92.9% and specificity of 100% a positive predictive value of 100 and negative predictive value of 99.3% in the diagnosis of TT, close to that of Yagil and al with Se 94% and Sp 96% [19]. This shows that DU is very effective in diagnosing TT.

The table 4 shows DU with Se 100%, Sp 99.3%, PPV 87.5%, NPV 100% for the diagnosis of Epididymo-orchitis, similar to that of Malwalddde and al with a Se 100%, Sp 92.7%, PPV 63.6 %, NPV 100%, but different from Rasool and al, with Se 77%, Sp 86%. This still tells us how effective DU is effective in the diagnosis of epididymo-orchitis. Table 5 show that DU is less sensitive in diagnosing orchitis but very specific.

Table 6 and DU is effective in the diagnosis of varicocele with a Se 92.9%, Sp 96%, PPV 99.2%, NPV 72.7%. Table 7 DU is effective in the diagnosis of normal testes with a Se 68.6%, Sp 96%, PPV 85.7%, and NPV 77.1%. Table 8 and 9 show that DU is very effective in diagnosing microlithiasis and epididymal cyst with Se 100% and Sp 100% for each

Table 10 show that there is significant statistical relationship between reversal flow in Valsalva manoeuvre and varicocele ($p=0.000$) and between epididymal size increase and varicocele ($p=0.000$). Also there is significant statistical relationship between absence of flow and the presence of TT ($p=0.000$) and also presence of whirlpool appearance and presence of TT ($p=0.000$).also there is significant statistical relationship between Hypervascularity and Heterogenous echostructure in the diagnosis of epididymo-orchitis with P values of 0.000 each. Also shows that there is significant statistical relationship between epididymal calcification and microlithiasis ($p=0.000$) and also anechogenicity and the presence hydrocele ($p=0.000$).

Table 11 shows that there is significant statistical relationship between governor's sign and the diagnosis of testicular torsion ($p=0.0000$) and also significant statistical relationship between Prehn's sign and the diagnosis of epididymo-orchitis.

These results of sensitivity and specificity show us that for our study any time a lesion was present the DU could predict and confirm its presence at least at 95% and any time the lesion was absent the DU could predict and confirm its absence at almost 100%. Hence making DU to be reliable non irradiating imaging tool in the diagnosis of scrotal pathologies. This helped to prevent unnecessary decision and permitted proper management of scrotal pathologies

CONCLUSION

In conclusion our study revealed that: Doppler ultrasound helped us determine the Sonographic features and imagine characteristics if the scrotal lesions. It permitted us to determine the correlation between clinical and Doppler ultrasound with agreements between clinical findings and Doppler ultrasound findings. Doppler Ultrasound was

effective in the evaluation of scrotal pain and swelling. With consistent values of sensitivity and specificity in the diagnosis of scrotal lesions and also helped us to differentiate between the different scrotal affections.

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