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ORIGINAL ARTICLE

Diagnostic value of transrectal combined scrotal ultrasonography in acquired obstructive azoospermia

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KEYWORDS
Obstructive azoospermia;
Location diagnosis;
Transrectal ultrasonography;
Scrotal ultrasonography

Abstract
Objective: To investigate the transrectal and scrotal ultrasonographic features of acquired obstructive azoospermia and evaluate the role of ultrasonography in the location diagnosis of acquired obstructive azoospermia patients.
Methods: Retrospectively analysis of 92 cases of acquired obstructive azoospermia in recent years. All the patients underwent transrectal and scrotal ultrasonography. The ultrasonographic features were observed of testis, epididymis, scrotal segment of vas deferens, seminal vesicle, ejaculatory duct and prostate. Eighty cases with normal semen were taken as control group.
Results: Among the 92 cases of acquired obstructive azoospermia, 28 cases were prostate midline cyst, 32 cases were stone or calcification of the ejaculation duct and 21 cases were chronic seminal vesicle inflammation, which were found through transrectal ultrasonography; 27 cases were vas deferens dilation, 30 cases had abnormal mass of epididymis tail, 31 cases were epididymis thickness with reticular change, 8 cases were cystic dilatation of rete testis, which were found through scrotal ultrasonography. Compared with the control group, ultrasound examination increased the detection rate of distal seminal duct lesions and epididymal lesions in acquired obstructive azoospermia patients ($p < .01$). Comparison of testicular volume between case group and control group did not reveal significant difference ($p > .05$). The thickness of the head, body and tail of epididymis in case group was significantly bigger than that in control group ($p < .01$).
Conclusion: Transrectal and scrotal ultrasonography can find lesions in different parts of the seminal passage. Acquired obstructive azoospermia patients have increased rate of distal seminal duct lesions, epididymal lesions and epididymis volume. Transrectal and scrotum ultrasonography can provide reliable imaging evidence for the location diagnosis of acquired obstructive azoospermia.

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PALABRAS CLAVE
Azoospermia obstructiva;
Diagnóstico de localización;
Ecografía transrectal;
Ecografía escrotal

Valor diagnóstico de la ecografía transrectal y escrotal en la azoospermia obstructiva adquirida

Resumen
Objetivo: Investigar las características ecográficas transrectales y escrotales de la azoospermia obstructiva adquirida y evaluar el rol de la ecografía en el diagnóstico de localización de los pacientes con azoospermia obstructiva adquirida.
Métodos: Análisis retrospectivo de 92 casos de azoospermia obstructiva adquirida en los últimos años. Todos los pacientes fueron sometidos a ecografía transrectal y escrotal, observándose las características ecográficas en los testículos, epidídimo, segmento escrotal de los conductos deferentes, vesícula seminal, conducto eyaculatorio y próstata. Se tomaron ocho casos con semen normal, como grupo control.
Resultados: Entre los 92 casos de azoospermia obstructiva adquirida, se detectaron mediante ecografía transrectal 28 casos de quiste prostático de línea media, 32 casos de cálculo o calcificación del conducto eyaculatorio y 21 casos de inflamación crónica de la vesícula seminal; también se detectaron mediante ecografía escrotal 27 casos de dilatación de los conductos deferentes, 30 casos de masa anormal en el tallo del epidídimo, 31 casos de grosor del epidídimo con cambio reticular y ocho casos de dilatación quística de la *rete testis*. En comparación con el grupo control, el examen ecográfico incrementó la tasa de detección de las lesiones del conducto seminal distal y las lesiones epididímicas en los pacientes con azoospermia obstructiva adquirida ($p < 0,01$). La comparación entre el volumen testicular entre el grupo de casos y el grupo control, no reveló ninguna diferencia significativa ($p > 0,05$). El espesor de la cabeza, cuerpo y cola del epidídimo en el grupo de casos fue significativamente mayor que en el grupo control ($p < 0,01$).
Conclusión: La ecografía transrectal y escrotal puede detectar lesiones en diferentes partes del conducto seminal. Los pacientes con azoospermia obstructiva adquirida tienen una tasa incrementada de lesiones del conducto seminal distal, lesiones epididímicas y volumen epididímico. La ecografía transrectal y escrotal puede aportar evidencia de imagen fiable para el diagnóstico de localización de la azoospermia obstructiva adquirida.

Introduction

Azoospermia is an important cause of male infertility, and the proportion of obstructive azoospermia is as high as 2/3.[1] The etiology of obstructive azoospermia can be divided into congenital dysplasia of vas deferens, inflammatory obstruction or iatrogenic causes.[2] Transrectal ultrasound can clearly observe the structural abnormalities of ejaculatory duct and seminal vesicle gland.[3] Scrotal ultrasonography can provide a basis for the diagnosis of azoospermia due to acquired obstruction of the proximal vas deferens.[4] High frequency transscrotal ultrasound combined with transrectal ultrasound can also accurately diagnose azoospermia.[5] The purpose of this study is to evaluate the value of transrectal ultrasound combined with scrotal ultrasound in the location diagnosis of acquired obstructive azoospermia.

Data and methods

Research object

From October 2017 to December 2019, 92 cases of acquired obstructive azoospermia (case group), excluding retrograde ejaculation, were identified through clinical physical examination, semen analysis, diagnostic or therapeutic epididymal puncture/testicular fine needle aspiration cytology with age 33.8(23–51). In the same period, 80 cases of normal semen test were selected as the control group with age 31.6(22–47).

Instruments and methods

Simens2000 and Hivision Preirus color Doppler ultrasound diagnostic instrument equipped with transrectal probe. The superficial linear array probe 9L4 with 12 MHz probe frequency was selected for scrotal examination. Patients lied supine, raised penis, and exposed scrotum. Covered the probe with condom, applied couplant, and scanned the testis, epididymis, spermatic vein, vas deferens. We observed the morphological structures, measured their sizes, observed whether the pipelines expanded, and stored the images. The transrectal probe EC9-4 with a frequency of 5–7.5 MHz or transrectal biplane probe EUP-U533 with a frequency of 4–8 MHz was used for transrectal examination. Patients lied on the left side, bent his hands and held his knees. Applied a small amount of couplant on the surface of the probe, tightened the condom,

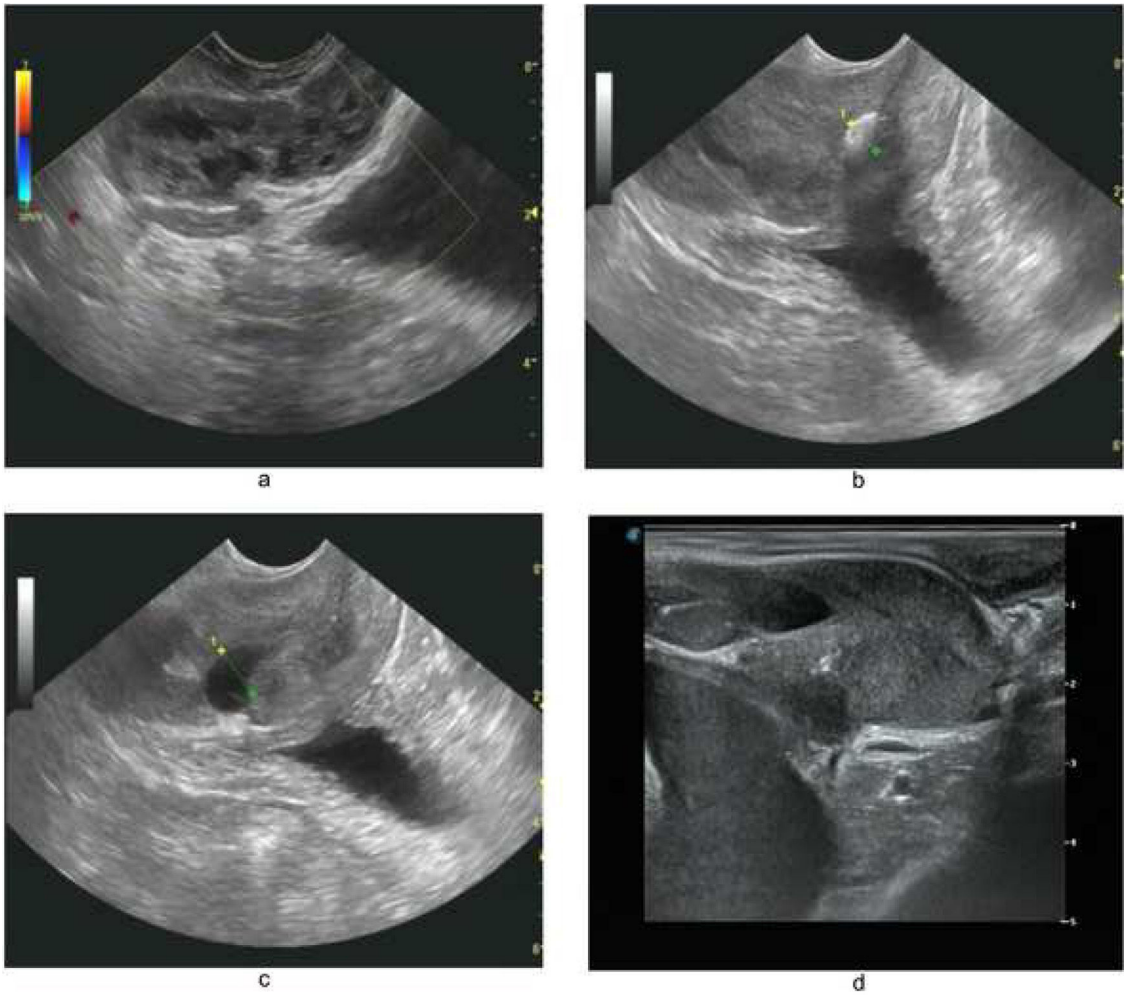

Figure 1 Transrectal ultrasound findings in acquired obstructive azoospermia, (a) chronic seminal vesicle inflammation, (b) ejaculation duct stone or calcification, (c and d) prostate midline cyst.

and insert the probe into the anus slowly after applying a proper amount of couplant on the surface again. Observed the prostate, ejaculatory duct, seminal vesicle and ampulla of vas deferens, and stored the images. The volume of testis was calculated by Lambert formula[6]: Volume (ml) = length × width × height × 0.71.

Statistical methods

Spss19.0 statistical software was used to process the data, *t* test was used for quantitative data, and χ^2 test or Fisher test was used for qualitative data, and the difference was statistically significant when $P < 0.05$.

Result

Among the 92 cases of acquired obstructive azoospermia, 28 cases were prostate midline cyst, 32 cases were stone or calcification of the ejaculation duct and 21 cases were chronic seminal vesicle inflammation, which were found through transrectal ultrasonography (Fig. 1); 27 cases wee Vas deferens dilation, 30 cases had abnormal mass of epididymis tail, 31 cases were epididymis thickness with reticular change, 8 cases were cystic dilatation of rete testis, which were found through scrotal ultrasonography (Fig. 2). Compared with the control group, ultrasound examination increased the detection rate of distal seminal duct lesions and epididymal lesions in acquired obstructive azoospermia patients ($P < 0.01$) (Table 1). Comparison of testicular volume between case group (12.6 ± 2.4 ml) and control group (13.2 ± 2.3) did not reveal significant difference ($P > 0.05$). The thickness of the head, body and tail of epididymis in case group was respectively (0.94 ± 0.13) cm, (0.62 ± 0.10) cm, (0.66 ± 0.07) cm, which was significantly bigger than that in control group, whose thickness was respectively (0.74 ± 0.11) cm, (0.29 ± 0.09) cm, (0.40 ± 0.07) cm ($P < 0.01$).

Discussion

The seminal duct include testicular reticulum, testicular efferent tubule, epididymal tubule, vas deferen, seminal vesicle and ejaculatory tubule. Any lesion of these parts may lead to obstruction of the seminal duct, and result in the occurrence of azoospermia.

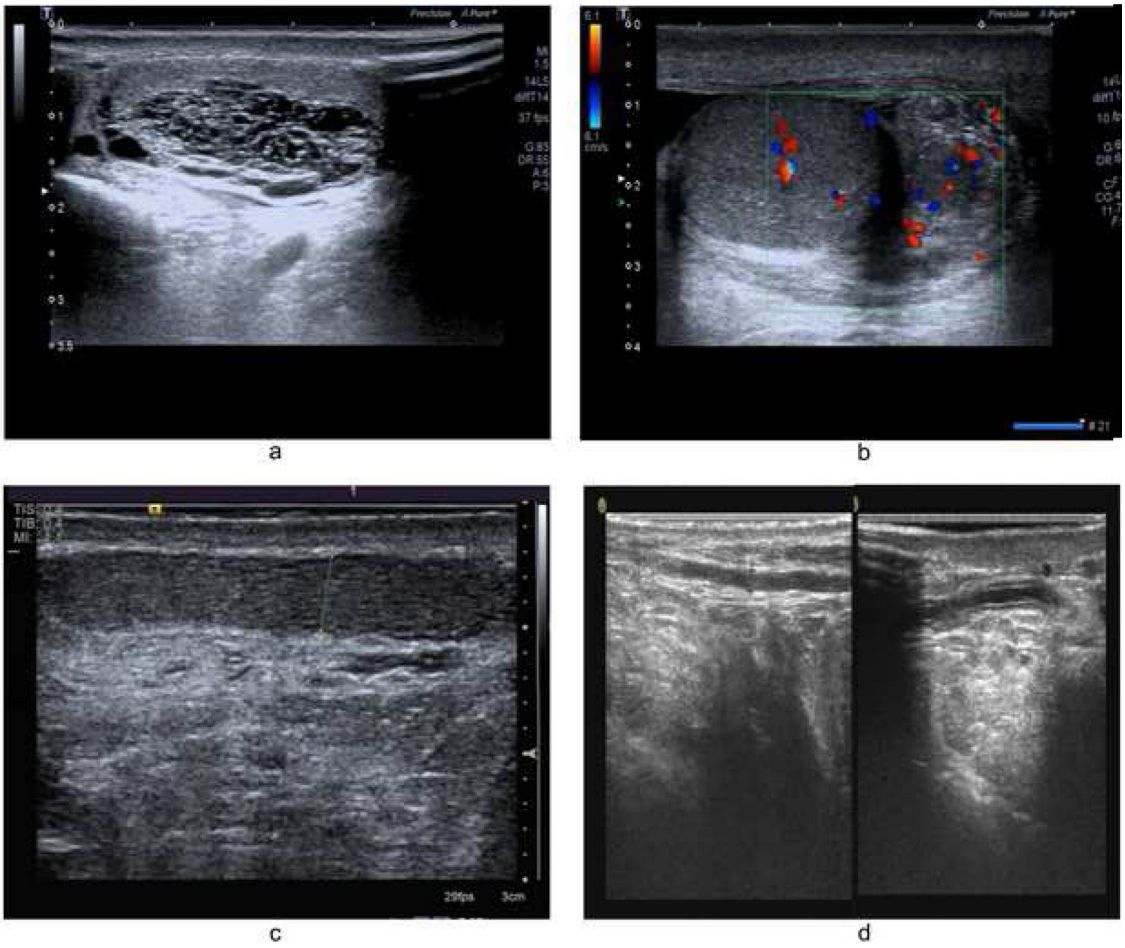

Figure 2 Scrotal ultrasound findings in acquired obstructive azoospermia, (a) expansion of the rete testis, (b) mass of epididymis tail, (c) thickening epididymis body with reticular change, (d) vas deferens dilation.

Table 1 The comparison of the case group and the control group(n).

Comparison items	Case group (92)	Control group (80)	t/X^2	P
Age (year)	33.8 ± 5.6	31.6 ± 4.9	2.66	<0.05
Semen				
Volume (ml)	3.4 ± 1.1	1.2 ± 0.55	16.21	<0.05
Value of pH	7.2 ± 0.35	7.4 ± 0.38	3.59	<0.05
Transrectal ultrasonography				
Prostate midline cyst	28	8	10.80	<0.05
Ejaculation duct stone or calcification	32	11	10.10	<0.05
Chronic seminal vesicle inflammation	21	6	7.60	<0.05
Scrotal ultrasonography				
Vas deferens dilation	27	10	7.19	<0.05
Thickening epididymis with reticular change	31	10	10.58	<0.05
Mass of epididymis tail	30	14	4.25	<0.05
Cystic dilatation of rete testis	8	4	0.90	>0.05

The main reason for the obstruction of the seminal duct is the obstruction of the distal end of the ejaculatory duct, which can be congenital or acquired obstruction caused by inflammation or compression of adjacent organs.[7] The most important cause of acquired obstruction is the compression of ejaculatory duct by midline cyst of prostate, which includes Mullerian duct cyst and ejaculatory duct cyst, which are difficult to be distinguished by transrectal ultrasound.[3] However, to make clear the relationship between the cyst and the ejaculatory duct opening and the location of the

cyst and the prostate is helpful to judge the nature of the midline prostate cyst.[8] In this study, 28 cases of prostate midline cysts were found, which were manifested as echo free, clear boundary, regular shape, good sound transmission in the cysts, lower tip and upper circle like inverted water drop shape. The stone or calcification of ejaculatory duct is also one of the causes of obstruction of spermatic duct. Most of the stones in ejaculatory duct are formed from seminal vesicle and then come to the opening of ejaculatory duct due to the scouring effect during ejaculation, and finally are embedded in this part. The formation of calcification of ejaculatory duct is related to obstruction and infection of seminal vesicle. In this study, 32 cases of prostatic calculi or calcification were found, which manifested as strong echo along the ejaculatory duct. The seminal vesicle is not an organ for storing sperm, but it can secrete specific secretory components such as fructose and prostaglandin, which are the source for sperm to obtain energy and power. When the seminal vesicle has pathological changes, it directly affects the sperm vitality. Chronic seminal vesiculitis can cause semen secretion disorder, which is prone to male infertility.[9] In this study, 21 cases of chronic seminal vesiculitis were found. The ultrasonography findings were that the seminal vesicle was slightly large or normal, the surface of seminal vesicle was tortuous and straight, the wall was rough and thickened, the echo was enhanced, the semen in seminal vesicle had poor sound transmission, and there were small strong light spots. Because of the lack of specific criteria for ultrasound findings, comprehensive analysis of clinical data, especially laboratory results, should be combined. The scrotal segment of the vas deferens is located behind the plexus of the spermatic vein, with a normal outer diameter of 1.8–2.4 mm and an inner diameter of <1 mm, whose acquired expansion is due to hernia repair, testicular fixation, vasectomy, and seminal lesions of the prostate.[10]

The epididymal segment of acquired obstructive azoospermia is characterized by enlargement of epididymis, regular fine reticular change, enhanced echo of epididymal wall, inflammatory mass at epididymal tail, dilated epididymal tube in and near epididymal tube, and punctate or patchy strong echo sometimes in epididymal tube, which appears as floating phenomenon due to accumulation of dead sperm or epithelial cells.[11] The thickness of epididymal head, body and tail was measured by ultrasonography, which has certain diagnostic significance for obstructive azoospermia.[12] In this study, the thickness of the head, body and tail of epididymis in the case group was significantly bigger than that in the control group; 30 cases of abnormal epididymis mass were mostly secondary to epididymitis; 31 cases of local thickening of epididymis with reticular changes, the formation of which may be related to the change of pressure in the epididymis tube. The normal testicular reticulum and the efferent tubules are fine and densely distributed, so they tend to be hyperechoic, which can not be distinguished by ultrasound at present. Mediastinum of testis is formed by invagination of tunica albuginea, which is tough in texture. The rete testis in the middle of mediastinum is not easy to expand when the distal end is obstructed. In this study, 8 cases of cystic dilatation of rete testis were found, who were all old people without relevant operation history. The formation of cystic dilatation of rete testis may be related to mechanical obstruction or androgen deficiency. The simple dilatation of testicular efferent tubules may also be due to the abnormal development of tubules or the obvious obstruction of epididymal tubules, and the degree is light.[10] The normal range of testicular volume varies with race and stature, but it is generally believed that testicular volume less than 11 cm^3 indicates severe spermatogenesis dysfunction, while testicular volume of patients with obstructive azoospermia is significantly larger than that of patients with non obstructive azoospermia.[13] In this study, there was no significant difference in testicular volume between patients with acquired obstructive azoospermia and those with normal semen. Transrectal combined with scrotal ultrasound can find the lesions of the proximal and distal seminiferous tract, but for the detection of the middle part of the vas deferens in the pelvic cavity, the effect of ultrasound is still not very ideal, so it needs to be combined with other examinations to make a definite diagnosis.

In conclusion, transrectal combined with scrotal ultrasound can find lesions in different parts of the vas deferens, accurately and quickly determine the cause of obstruction, avoid unnecessary invasive examination, and provide reliable imaging basis for the location diagnosis and clinical treatment of acquired obstructive azoospermia.

Ethical disclosures

Protection of human and animal subjects. The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Conflict of interest

The authors declare that they have no conflict of interest.

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