**The diagnostic algorithm patients examination with penile deformation.**

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The article outlines informational content of the methods used for treatment and diagnostic algorithm development for patients with different types of of penile deformations. It is given retrospectively the assessment to ultrasound, X-ray, and magnetic-resonance tomography, as well as are evaluated the results of surgical treatment of patients with penile deviations. There are provided recommendations to examitaion of patients with penile deformations of different etiology.

Key words: penile deformation, Peyronie’s disease, ultrasound, magnetic-resonance tomography (MRT), diagnostic algorithm

It is difficult to argue that that quality of life improvement is an essential task of contemporary medicine. One of the most important components of comprehensive life of the modern man is a sexual life which depends not only on functional state of penis but also on its anatomical structure, which can be evaluated upon penis skin status , localization of the external urethra opening , penis size and absence of any strains[1].

Penis deformation is caused bychanges of its any anatomical structures. In 1996 Dr. Scheplev P.A. has systematized all penis deformation on the basis of two criteria: physiological condition in which the penis appears deformated and penis anatomical structure defeat which causes deformation; that all allows to sum it up to the genesis of this pathology:

1. Penis curvature that occurs only in the erectile state:  
- Damage localized in the tunica albuginea;  
- Peyronie's disease;  
- Congenital deformity of the penis;  
- Local fibrosis;  
- Erectile deformation due to defect of inflatable cylinders prosthesis.  
2. Penis curvature appeared out of erection conditions:  
- Congenital short urethra;  
- Epispadias;  
- Hypospadias;  
This type of deformation can be visualized in non erect penis position position and is enhanced during erection.

3. Penis curvature appeared in non erect penis and not enhanced during erection:  
- Cavernous fibrosis;  
- Migration of penile prosthesis;  
- Glans penis diseases (ptosis, haemangioma);  
- Diseases of the skin and fascia (granuloma, twisted penis, scar deformity, genital elephantiasis).

   During the last years, detection frequency of the penis deformation has significantly increased , and the number of patients who wish to receive adequately both methods of conservative and surgical treatment is growing up. Not all types of penis deviation are applicable for surgical correction, in particular dorsal deformation less than 45 ° which allows patients to have normal sexual life. However, lateral and ventral penile curvature less than 30 ° can significantly complicate introjection and require surgical intervention.

Surgical treatment of acquired penile curvature (Peyronie's disease, local fibrosis, diseases of the skin and fascia etc.) must be conducted only in case of disease is stable for 3 months providing that duration of the disease is at least for 1 year, that all can ensure adequate and long-term results of correction [2]. The choice of surgical treatment method of penile curvature is primarily dependent on the presence or absence of erectile dysfunction, as well as presence or absence of inflammation, level of deformation and size of penis. [9]. Pre-admission it is important to identify possible organic genesis of erectile dysfunction. Provided that organic changes which influence on erectile mechanism are not revealed surgical correction should be focused on the elimination of erectile deformation [3,7].

At the moment the following diagnostic methods are used to detect patients with penis deviation: ultrasound, (US), pharmacodoplerographiya or pharm induced duplex ultra-sonography, magnetic resonance imaging (MRI) as well as X-ray of the penis using the soft rays and X-ray computer tomography (CT).

For the moment ultrasound is the priority diagnostic method of patients with penis deviation and intracavernous fibrosis due to its low cost and noninvasive technique which allows to reveal changes in intracavernous septum and possible localization, size and calcification area of ​​calcified fibrous on penis tunica albuginea . However, ultrasound does not provide high quality images in all cases, especially the early stages of the disease when inflammation is dominant it allows to vizualizefibrotic induration only in 66-72% [10,11]; in addition, it is low informative for evaluation of inflammation level.Duplex scanning allows toevaluate simultaneously the hemodynamics in the vessels and anatomical changes in the corpora cavernosa of penis. As a rule basic examination consists of sonography in B-mode of cavernous and spongy bodies, tunica albugineaand both cavernousarteries. Then, it is evaluated the blood flow in at the same location using color Doppler. With theDoppler method it is possible to assess microcirculation better . It is a must to evaluate blood vessels reactivity as a response to erection stimulation with medicaments for choosing a correct method of penis deviation treatment and patients selection for penis prosthetic repair. Therapy with prostaglandin E1 medicaments is used. Medication injections are administered intra caverns with subsequent evaluation of blood flow in cavernous arteries for 20-30 minutes with 5 minutes intervals. As a response to pharmacological stimulation the cavernous arteries diameter in normal conditions becomes approximately doubled and quality assessment of blood vessel walls and its opening becomes possible for the whole length as well as spiral arteries of cavernos corpora and numerous collaterals between arteries are visualized.

The main quantitive indicators are the maximum (peak) systolic velocity (PSV) and end diastolic velocity (EDV).

On the basis of absolute values ​​using the standard formulas following relative parameters are calculated: resistance index (RI), and pulse index (PI)% [12,6]. Deep dorsal vein is also easily accessible for visualization. As a response to vasoactive substances blood flow in it is reduced or even completely subsided. Persistent blood flow in the dorsal vein after the administration of vasoactive substances is a specific sign of venous leakage.

Magnetic resonance imaging enablesto provide expanded  
amount of information due to the high dimensional resolution and the possibility of multiple images. Initially high tissue contrast of MR images can be enhanced by use of contrast agents. This method allows to make visible not only changes in the tunica albuginea but to have judgment regarding of affection of corporacavernosa, correlations of possible fibroplastic induration in the penis arteries. [8] The use of paramagnetic contrast agents significantly expands the range of diagnostic capabilities of MRI increasing its sensitivity and specificity [4].

Penis survey X-ray makes it possible to visualize plaque only in case of avaliability of plaque’s calcification areas. Taking in consideration relatively low informativity of this diagnostic method especially on early stages of the disease, as well as availability of radiation exposure, X-rays of penis t is recommended to be used only for differential diagnosis of Peyronie's disease. Cavernosography allowsto evaluate level of pathological process extension provided onlyavailability of filling defect of contrast agent while spreading inside of corpora cavernosa and it is also used to examine venous hemodynamics of penis. So, taking in consideration invasiveness and radiation exposure the use of this method is limited.

Spiral computer tomography of penis allows to estimate severity of clinical symptoms and morphological changes of penis. It enables determination of biomechanical characteristics of penis, such as density of pathological areas, asymmetry degree for calculation of cross-sectional areas of corpora cavernosa, and pressure on adjacent undamaged areas of tunica albuginea. This information can be important for determination of surgery volume and selection of grafts for corporoplastic [5].

The objective of this study was to determine the optimal diagnostic method of penile deviation according to its type for further treatment tactic selection and minimization of negative results of surgical treatment.

**Materials and methods**

For the period from 2004 till 2015 there were 189 patients with penile deviations of the age from 18 till 74 years old in Andrological department of Kharkiv Regional Clinical Center of Urology and Nephrology named by V.Shapoval for examination and treatment were. The largest group of patients had Peyronie's disease - 102, congenital deviation - 49, local fibrosis - 17, hypospadias, a congenital short urethra -12, cavernous fibrosis - 9. Pre-surgery examination comprised medical history, physical examination, ultrasound, and pharmacodoplerography and magnetic resonance imaging upon necessity. X-ray of penis in the soft rays cavernosography and X-ray computer tomography were performed in a few controversial and questionable clinical cases, as invasiveness and radiation exposure were taking into consideration.

Patients’ examination has determined the choice of medical and surgical method treatment for penile curvature which was mainly depend on the presence or absence of erectile dysfunction, inflammation, as well as level of deformation and the dimention of penis.

135 patients had surgical treatment and 54 patients were treated with medicaments only. The choice of surgery method was discussed together by doctor and patient, depending on level and type of penis deformation, erectile function ratio, clinical symptoms of the disease, as well as length of penis and patient's expectations.

**Results and discussion**

In the group of patients with congenital deviation who underwent surgery corporoplication by Nesbit, as well as in patients with curvatures that are produced penile prosthesis, positive results were observed in 94% of patients. Unsatisfactory results indicated 6% of patients who are associated with a decrease in the length of the penis.

In the group patients who were operated corporoplastic without prosthetics complete lack of deviation of the penis was observed in 82% of patients. The residual distortion (less than 15%), which does not reduce the functionality of the penis, was recorded in 18% of patients. Reducing the length of the penis marked 16%. After surgery, all patients erection remained at the preoperative level. However, after 2 years of observation, the deterioration of erectile function noted 19% of patients. We performed a retrospective analysis of preoperative examination and the results of surgical treatment.

It is noted that ultrasound in the early stages of the disease is not always possible to visualize fibrplastic induration tunica albuginea penis does not assess the activity of the inflammatory process. In order to identify structural changes in the cavernous fibrosis, and Peyronie's disease was carried ultrasound B-mode. Cavernous fibrosis in gray scale heterogeneity hypoechogenic looked like normal corpora cavernosa, which revealed echogenic foci. Peyronie's disease was noted local or diffuse thickening of the tunica iso - or slightly hyperechogenic, with possible acoustic shadows in the calcification of fibrous plaques.  
When Doppler lower maximum (peak) systolic velocity (PSV) in the cavernous arteries after pharmacological stimulation testified in favor of the arterial erectile dysfunction.  
    It should be noted that in addition to PSV, indices of arterial insufficiency were slow acceleration and low value of the acceleration. Duplex method made it possible to directly visualize vessels. The narrowing of the vessel lumen and wall calcification was typical of the atherosclerotic lesion. Lack of increase in cavernous artery diameter in response to pharmacological stimulation indicated the loss of elasticity of the walls.

MRI reveals patients with severe inflammation in the early stages fibroplastic induration, cavernous fibrosis leads to a deviation of the penis, and the predicted positive effect of conservative therapy.  
When using contrast agents increase the focal MR signal intensity during MRI indicative of active inflammation, and thus made it possible to obtain information about the severity of fibroplastic process.

In doubtful cases, the clinical carried spiral computed tomography allows the penis to calculate the severity of clinical symptoms and morphological changes of the penis, however, taking into account radiation exposure, its use was limited to us.

**Conclusions**

Pre-surgery examination of patients with penile curvature and any type of deformation must comprise ultrasound and pharmacodoplerography along with the medical history and physical examination. In controversial clinical cases in order to prove or discard possible inflammatory peri-process it is necessary to conduct magnetic resonance imaging and spiral computer tomography of penis which allow to calculate clinical symptoms severity and morphological changes of penis. Diagnostic results undervaluation of erectile dysfunction and inflammation after examination of patients with penile deviations on pre-surgery stages leads to its progressing inpost- surgery period and increases amount of negative post-surgery results.

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