EVALUATION OF CLINICAL STATUS AND FUNCTION OF STALLION TESTIS

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Clinical evaluation of stallion testes always includes visual inspection of the scrotum, manual palpation of scrotal contents and measurement of total scrotal width or more detailed testicular dimensions (1). These "classical" methods let us confirm the presence of both scrotal testes, evaluate their position, shape, size, texture, sensitivity, mobility within scrotal cavity and local temperature of scrotal skin. This simple, fast and cheep examination brings lots of crucial information on the physical status of male gonads. It is a basic part of breeding soundness evaluation of all male animals kept for breeding purposes as well as an initial portion of evaluation of male animals with reproductive disorders. However, in 80-ties and 90-ties new techniques have been introduced to veterinary medicine and found their applications in diagnosing some causes of andrological problems. Noninvasive techniques, such as ultrasonography have a particular value in evaluating such sensitive organs as testes. Thanks to these methods we can visualize their echotexture and presence of subtle pathological structures (2). There are also some invasive techniques, such as needle aspiration or biopsy, that are used only in particular cases that require additional information (3,4).

Physical examination of the stallion scrotum and its contents is usually performed just after semen collection (5). Relaxation of the stallion after ejaculation makes this procedure easier, and more efficient. However, one shouldn't neglect initial palpation of scrotal pouch before first attempt to collect semen. In cases such as scrotal hernia, orchitis or cryptorchidism, etc., collection of semen may be unnecessary or even risky.

Integrity of a skin of the scrotum may be evaluated by **visual inspection**. Simultaneously, one should check symmetry, shape and size of both sides of the scrotal pouch. Left testis is often larger and heavier than the right one so it is hanging slightly lower than the other one (1). However, significant discrepancy in size of both testes may suggest some abnormalities such as testicular degeneration due to trauma, hernia, unilateral hydrocele, testicular tumor, orchitis, etc. Shape of the stallion testis is usually ovaloid, however, it may be pear-shaped, especially in a case of the presence of the lateral (additional) branch of testicular artery running through the lateral surface of the testis (6). Trophic effect of these additional arteries is particularly evident when two additional, lateral branches of testicular artery are present on the lateral surface of the testis. There are stallions with one testis of the regular, ovaloid shape and another one that have a very pronounced protrusion on the side, located usually in cranial part of the testis, due to this specific vasculature. Another, frequent reason of such "bulging" testis is slight torsion of spermatic cord (about 90º) which causes dislocation of tail of epididymis from caudal to lateral side of the scrotum.

Some of the abnormalities of the scrotum may be diagnosed by **manual palpation**. It is necessary to localize all the usual structures in their normal location. There are cases with other structures than testes present in the scrotum which may look normally. Big haematoma or abscess may completely fill one side of the scrotal pouch. Also, in extreme cases, there may be devices such as breast implants that have been surgically introduced into the scrotum in purpose, in order to hide cryptorchidism (7). Testes should have uniform, elastic texture and should be movable within vaginal cavity, shouldn't be excessively sensitive. Careful palpation of entire epididymis and the ligament of epididymis is also necessary (5). Increased local temperature of

the skin of the scrotum, pain, changed texture, presence of palpable, unusual structures within testicular parenchyma, epididymis, or vaginal cavity, such as fluctuating fluid, etc. are abnormal and require further investigation and proper diagnosis. Unfortunately, at this point, when testicular or epididymal pathologies are already palpable, they are usually already very advanced and prognosis may not be very favorable. Therefore, when spermiogram suggests testicular or epididymal abnormalities or evaluated animal has a history of scrotal insult, etc., additional methods of clinical evaluation should be used. **Imaging techniques** such as ultrasonography may be very useful in such situations. It allows to visualize inner structure of the examined organ and often localize even very early, slight pathologies (2). On the other hand, however, there are cases with palpable changes in the scrotum that are difficult to diagnose with ultrasonography. Therefore, basic methods of clinical evaluation such as manual palpation should be never neglected.

For **ultrasound evaluation** of stallion scrotum regular machines, used for reproductive, veterinary work may be used. Linear, 5MHz probe is quite adequate to visualize echostructure of testicular parenchyma and spermatic cord. However, higher frequency probes (7,5 or even 10 MHz) may be very useful for more detailed examination of epididymis or pathological changes. Also, other than linear probes, especially convex type, may be used. However, sector probes are rather inconvenient to apply in this examination because of lack of space between stallion thigh and testis. Majority of stallions tolerate ultrasound evaluation of their scrotum rather well. However, there are individuals that would resist even manual palpation of this region and therefore necessary precautions should be undertaken. We can protect our equipment from being kicked by placing stallion's hindquarters into the corner and machine on the side in reasonably safe distance. The wall behind stallion's hind legs should be protected by mattress or other material that would prevent stallion from being injured while kicking (8). Ultrasound machine may be also placed on a side of a wall of stallion's box or tie stall while stallion is standing parallel to it with his hindquarters separated by this wall. Ultrasound gel may be applied on a probe or straight on a skin of the scrotum. Linear probe is usually placed directly on the surface of the scrotum, perpendicular to the long axis of the testis on the ventral, lateral or medial side in order to obtain images of various cross sections of testis and epididymis. It may be also placed parallel to the long axis of the testis in order to obtain images of longitudinal sections of scrotal contents. Testicular parenchyma should be uniformly echoic throughout entire organ except nonechoic dots or bands that are visualization of testicular vessels (2). Increased echogenicity of testis is usually the effect of advanced testicular fibrosis or other, chronic and progressive process, while decreased echogenicity may suggest testicular degeneration. Focal changes of echogenicity of the testis as often associated with the presence of tumors of various origin or may be a symptom of haematoma, abscess or local inflammation. Central vein is a most pronounced venous vessels of the testis. It begins its course from the caudal pole of the testis and runs through this organ towards its cranial pole, and slightly dorsally to the spermatic cord. Properly obtained ultrasound images of cross sections of the caudal part of the testis should contain small black dot in its central part corresponding to the lumen of central vein in this area. It is becoming larger and it is positioned more dorsally in images of central and cranial parts of the testis. Longitudinal sections of this vessel may be also visible on ultrasound images of stallion testes. However, it is rarely visible as a continuous band since central vein does not have exactly straight course. Arterial vessels are less frequently visible on ultrasound images of stallion testes (2, 8). Testicular artery runs along an epididymal edge of the testis within tunica albuginea, around its caudal pole, then is continuing its route as a single vessel along a free edge

of the testis towards a cranial pole until it penetrates testicular parenchyma. It has very tortuous course and therefore one can see multiple cross and oblique sections of its lumen only on the edge of the testis, most often on ultrasound images of longitudinal sections of the caudal pole of it (6). Smaller arterial vessels running through testicular parenchyma are not visible on ultrasound images, unless they are enlarged due to some pathologies such as inflammation, vascular malformations, tumors, etc. Vaginal tunics are easily detectable on ultrasound images of scrotal contents as a thin, echoic layer around the testis. Thickening of vaginal tunics or a presence of nonechoic fluid within vaginal cavity are abnormal. Echostructure of stallion epididymis is not as uniform as echostructure of the testis. There are multiple echoic or nonechoic dots visible on ultrasound images of epidiymal tail, corresponding to cross sections of epididymal duct. Efferent ducts and proximal part of epididymal duct has much narrower lumen than its distal part and therefore they are not easy to visualize using ultrasound unless it is distended due to spermiostasis. Ultrasound images of cross sections of spermatic cord contains nonechoic areas of so-called "cheese-like" appearance corresponding to multiple sections of testicular artery under various angle (2). However, we may also see enlarged, nonechoic areas that correspond to distended fragments of venous system (pampiniform plexus) or lymphatic vessels. Such abnormal structures may be difficult to distinguish from arterial system, unless evident pulsation is seen or **Doppler ultrasound** is used. This technique allows to objectively measure velocities of blood flow through various vessels that have characteristic values for particular organs, including testes. They may change due to some pathologies, such as inflammation, tumors, degeneration, etc. It may help in detecting early stages of these abnormalities way before they are diagnosable using other methods. Grey-scale and color-coded, spectral Doppler ultrasound has been used in human andrology for quite a few years. Recently, it has been also introduced into veterinary medicine, including equine andrology (9). Various vascular malformations, hyperemia, abnormal vascularisation of testicular tumors, vericocele, etc, are very well visible on color-coded Doppler ultrasound images.

Application of various, described above ultrasound techniques help to apply invasive procedures such as **testicular biopsy or needle aspiration** in a relatively safe way. Major possible complication of these clinical diagnostic methods is a massive hemorrhage that may affect or even destroy large areas of testicular parenchyma. It is very easy to injure large branch of testicular artery or veins while penetrating testis with a large-gage needle or biopsy punch. It may happen especially in cases when additional, lateral branch of testicular artery runs on the lateral surface of the testis. Majority of authors recommend to introduce biopsy instrument in cranial 1/3 part of testis exactly on the level of its central long axis (10). However, additional lateral branch of testicular artery may run exactly in this area so it must be found and omitted in order to prevent major bleeding. Also, biopsy punch or a needle should be stuck under nearly 90º in order to miss many small centripetal and centrifugal arteries that penetrates testicular parenchyma perpendicularly to testicular surface. Various studies have shown that these procedures, when performed properly, do not significantly and permanently affect function of stallion testis and may be necessary for diagnosis of testicular abnormalities such as tumors. It is crucial to distinguish progressive neoplastic changes from diminishing inflammatory, focal changes. Testis with neoplastic tumor should be removed, while inflammatory process may be treated pharmacologically (11,12). Loss of certain amount of testicular parenchyma has its consequences in decreased sperm production and therefore many horse breeders are hesitant to allow any invasive procedures on stallion testes, even if there is an evident recommendation to perform one of them.

Calculation of stallion **testicular volume** and **expected Daily Sperm Output** (DSO), based on three dimensions (width, height, length) measured with calipers or ultrasound, has been well described and is often performed in veterinary reproductive practice. Mathematical formulas for these calculations are based on ellipsoid-like shape of stallion testis and correlation between testicular volume and empirically determined DSO (13). These rules help to assess testicular function of the stallion, to predict his sperm production and to plan most efficient management strategy for coming breeding season. Low daily sperm output per ml of testis may be a valuable diagnostic information for the clinician on consequences of pathological changes such as testicular degeneration (14).

Stallion fertility depends on proper function of his testes. Even slight disturbances may greatly affect reproductive function of the animal. Clinical evaluation of male genitalia of breeding animals should be performed carefully and thoroughly then, in order to diagnose any pathologies, possibly in their early stages.

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