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Clinical Commentary

The diagnostic challenge of scrotal enlargement in the stallion

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Introduction

Mature intact stallions are underrepresented in the domestic horse population, primarily because most stallions are castrated at a young age to ameliorate the expression of sexual or aggressive behaviour. Nevertheless, because the major reason for maintaining an intact stallion is for the purpose of breeding they are often valuable animals. For expensive or potentially popular breeding stallions, it is common practice to evaluate testicular size as an index of semen production capacity and, depending on the studbook with which the stallion is to be registered, further parameters of semen production and quality may also be evaluated prior to acceptance or insurance as a breeding stallion. Once at stud, the external genitalia of stallions used to mate significant numbers of mares are inspected regularly, albeit fairly superficially, either after semen collection for artificial insemination or after natural cover. In most cases, per cycle pregnancy rates are also monitored throughout the breeding season. The aim of the initial checks is to ensure that the stallion has normal genitalia and can be considered 'breeding sound', whereas subsequent monitoring is focused on ensuring optimal reproductive efficiency, but has the added advantage of helping to identify any reproductive problems at an early stage. By contrast, intact stallions that are not used for breeding or used only on occasional mares, such as the Hackney pony stallion described in this issue (Stoll *et al*. 2015), are not regularly inspected or closely monitored and, as a result, the detection of subtle or chronic reproductive tract abnormalities is likely to be delayed.

Differential diagnosis and diagnostic work-up of scrotal enlargement in the stallion

Unilateral or bilateral scrotal enlargement is one of the most common and readily apparent genital tract abnormalities in the stallion. In the case reported in this issue, Stoll *et al*. (2015) were able to restrict the differential diagnoses for scrotal enlargement based on the absence of scrotal or testicular pain. An enlarged, painful scrotum can result from various inflammatory, obstructive or traumatic conditions including periorchitis, orchitis, epididymitis, testicular abscessation, testicular haematoma, inguinal hernia and torsion of the spermatic cord. In parallel with the presence or absence of pain, differential diagnosis can be greatly assisted by identifying the anatomical structure or site affected, where this may include the scrotal skin, vaginal tunic or cavity, testis, epididymis, or spermatic cord (**Table 1**). In this respect, the list of potential causes of an enlarged scrotum is quite large and it is important to identify the underlying aetiology in order to implement an appropriate treatment regime, be it specific or symptomatic, and offer a reliable prognosis. Rapid diagnosis can also be critical because some of the underlying conditions can have a profound detrimental effect on sperm production capacity, sperm quality and fertility and/or the general health of the stallion; indeed, a strangulating inguinal hernia will need emergency surgery to avoid severe complications while it is advantageous to detect testicular tumours early because some, in particular seminomas, have the potential to metastasise and thereby become life-threatening (Sherman *et al*. 1990).

The first step in the differential diagnosis of scrotal enlargement is to obtain a detailed medical and, if applicable, reproductive history followed by a general clinical examination (i.e. are there indications of systemic disease). Subsequently, the scrotum should be inspected and palpated noting the size, symmetry, consistency, orientation (as indicated by the position of the *cauda epididymis*), mobility, temperature and sensitivity to palpation of both testes and the other scrotal contents. Palpation of the scrotal contents of the Hackney pony stallion reported by Stoll *et al*. (2015) revealed a relatively large, firm mass attached to the left testis and several smaller masses connected to the right testis. The absence of pain as a presenting sign or during palpation helped significantly to narrow down the range of possible causes. Moreover, because the masses could be delineated from the testes during scrotal palpation, it was probable that they did not originate from the testicular parenchyma. Nevertheless, ancillary diagnostic techniques were quite rightly used to confirm the clinical impression. One ancillary technique that was not considered appropriate in the current case was semen evaluation. Semen evaluation can, however, be a valuable diagnostic and prognostic indicator in stallions with testicular or scrotal pathology, since it gives information about the number and normality of sperm cells and the presence of abnormal (e.g. inflammatory) cells, microorganisms etc. This can be particularly valuable during diagnosis and monitoring of the response to treatment in case of inflammatory conditions. Nevertheless, the most useful initial diagnostic tool for stallions with an enlarged scrotum is ultrasonography, which will assist localisation of any enlargements or abnormalities to anatomical locations within the scrotum and give an indication of the nature or composition of any abnormal structures. Indeed, scrotal ultrasonography in the Hackney pony stallion described by Stoll *et al*. (2015) confirmed that the masses were paratesticular, suggesting that they originated in either the *tunica albuginea* of the testis or the vaginal tunic, and further demonstrated that they were poorly vascularised soft tissue masses. The differentiation between a tumour originating from the testicular parenchyma as opposed to other tissues within the scrotum is of significance because, as mentioned above, some testicular tumours have been associated with a significant risk of metastasis. In cases of anticipated malignancy and indeed in stallions presenting with acute scrotal pain, ultrasonography of the spermatic cord

TABLE 1: Differential diagnosis of scrotal enlargement in relation to the affected scrotal structure

Scrotal structure	Scrotum	Vaginal tunics/cavity	Testis	Epididymis	Spermatic cord
Pathological condition	Scrotal oedema	Hydrocoele	Orchitis	Epididymitis	Torsion of the spermatic cord
	Scrotal laceration	Haematocoele	Testicular neoplasia	Sperm granuloma	Thrombosis of the spermatic artery
	Scrotal contact dermatitis	Pyocoele	Testicular abscess	Epididymal cysts	Varicocoele
	Neoplasia	Periorchitis Inguinal hernia	Testicular haematoma Testicular cysts	Neoplasia	
		Rent in the vaginal tunics with herniation of the testis	Testicular pseudocyst		
		Neoplasia	Ruptured *tunica albuginea* Neoplasia *tunica albuginea*		

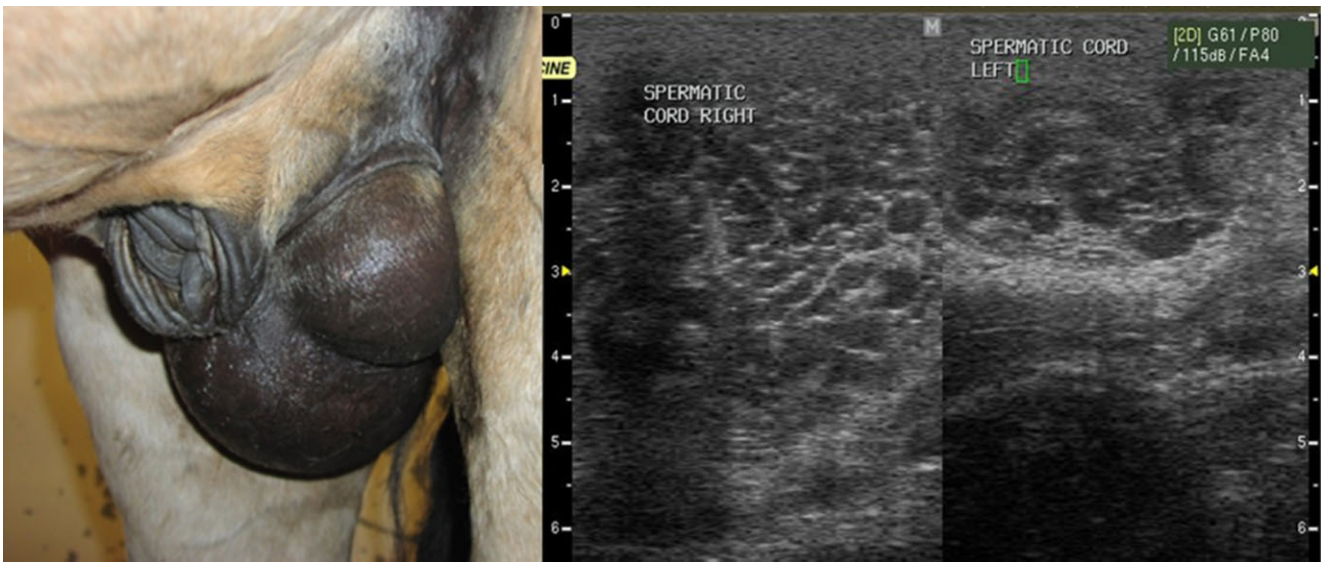

Fig 1: Unilateral scrotal enlargement in a stallion as a result of a seminoma. Scrotal ultrasonography revealed an enlarged right spermatic cord with several dilated vessels in the pampiniform plexus. In addition, a sizeable mass was palpated in the area of iliac lymph nodes indicating metastasis to at least the abdominal cavity.

becomes an integral part of the investigation since early stage metastasis can be evident as enlargements alongside the *pampiniforum plexus* and *vas deferens* (**Fig 1**), while in cases presenting with acute severe discomfort, ultrasonography of the spermatic cord can demonstrate the presence of abdominal contents (e.g. a small intestinal loop) in the inguinal canal and indicate whether vascularisation of the testicle is affected (arterial blood flow or venous return). Ultrasonographic changes in the spermatic cord associated with a testicular tumour indicate a necessity to perform further investigation for spread beginning with a rectal examination to investigate local metastasis into the draining lymph nodes or abdominal cavity. A potentially useful additional ultrasonographic modality when examining an intra- or paratesticular mass is colour Doppler, which, by highlighting vascular patterns, can help to distinguish between benign and malignant masses (Huang and Sidhu 2012). Last but not least, a needle biopsy of a mass can be performed to yield a histological diagnosis and help determine the most appropriate treatment. Nevertheless, in practice, histological diagnosis is often performed following orchidectomy, especially when the stallion is only unilaterally affected and removal of the affected organ will not signal the end of the breeding career.

Leiomyoma in the reproductive tract of the stallion

Leiomyomas are benign tumours that originate from smooth muscle cells. While there are a number of reports describing uterine leiomyomas in the mare (Muurlink *et al*. 2008; Heijltjes *et al*. 2009), it is still an uncommon problem, and there are even fewer reports of leiomyomas in the reproductive tract of

the stallion. The authors are aware of only 4 reports of a leiomyoma of the *tunica albuginea* of the testis in a stallion (Klug and von Lepel 1979; Johnson and Steinberg 1989; Wilborn *et al*. 2013; Stoll *et al*. 2015). Potentially significant questions that are not addressed by the current report are whether a leiomyoma of the *tunica albuginea* negatively affects the fertility of the stallion and whether radical excision including orchidectomy is essential. Any answers to these questions will remain speculative given the paucity of clinical cases. Nevertheless, a small leiomyoma located outside the testicular parenchyma would not be expected to have a direct negative effect on spermatogenesis. Over time or with enlargement, however, a leiomyoma in the neck of the scrotum could impede normal testicular movement and thermoregulation and even begin to impede normal vascular perfusion or efflux. The benign character of a leiomyoma suggests that complete local excision should probably be curative; however, in the current case the fact that the pathology was multicentric indicates multiple sites of origin and therefore a possibility of recurrence at other sites within the *tunica albuginea*, or as Stoll *et al*. (2015) suggest, elsewhere within the urogenital tract. Thus, while debulking the tumour would prevent pressure necrosis of underlying testicular parenchyma, it is difficult to determine whether tumour excision alone would have been sufficient to prevent local recurrence.

In conclusion, while we agree with Stoll *et al*. that neoplasia should be considered a possible cause of bilateral testicular enlargement, and there are also reports of bilateral neoplasia of testicular cell origin (Melo *et al*. 2007; Govaere *et al*. 2010), it is likely to be an unusual occurrence and would require a thorough diagnostic work-up involving, at the very least, ultrasonographic examination of the scrotal contents and possibly backed up by cellular level examination via semen collection or needle biopsy to assess effects on semen production and establish malignancy. Establishing that the tumour was benign would suggest that the prognosis in terms of survival is likely to be favourable even if treatment was limited to local excision to salvage reproductive potential. However, giving a prognosis for future fertility, even if semen quality was initially unaffected, may be more difficult given the risks of local recurrence necessitating orchidectomy, or resulting in progressively compromised testicular function due to compression or thermoregulatory dysfunction.

Authors' declaration of interests

No conflicts of interests have been declared.

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