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Pyriform and Tapered Heads

The prevalence of pyriform head defects are relatively high and are either the most or second most prevalent defect in an ejaculate [3, 30–34]. The classical pyriform sperm has a pear-shaped head, a normal acrosome, and a narrow post-acrosomal region [3, 35–37]. Sperm with irregularity in head shape and size generally have good motility [3].

Several variants of pyriform head defects have been reported, ranging from slightly affected to severely tapered through the acrosome and post-acrosomal regions. The main initiating factor for this deformity appears to be adverse environmental conditions impacting male health and fitness [3, 38]. Pyriform sperm have been noted in ejaculates three to four weeks after initiation of dexamethasone injections to simulate stress, following scrotal insulation, or exposure to high ambient temperatures in the case of rams [3, 5, 38]. Pyriform or tapered heads have also been noted in those suffering from obesity resulting in scrotal or inguinal deposition of fat, frostbite or dermatitis of the scrotum, varicoceles, or other injuries that impede proper testicular thermoregulation [3]. Disruptions in endocrine hormone balance occurring either systemically or locally may also be implicated. Local disruption is caused by abnormalities in testicular thermoregulation while systemic disruption descends from unfavorable conditions or events that cause stress to the animal. These stressful events can include chronic pain, joint pain, conditions affecting the hooves including lameness or laminitis, extremes in weather, housing or social stress, improper nutrition, or travel [3].

Differences in the severity of response between males with similar treatments suggest that some males may be genetically predisposed to develop pyriform heads in response to adverse environmental influences [3, 5, 29]. In most instances, there will be many other sperm abnormalities present in the ejaculate, indicating a disturbance in spermatogenesis has occurred. However, after removal of stress factors, males often return to normal sperm production [3].

Small numbers of pyriform or tapered defects can be found in the semen of most bulls, even in bulls of good fertility [3]. In a study of bulls used for natural service and artificial insemination, percentage of bulls producing affected sperm were 9 and 16%, respectively. The percentage of pyriform sperm in an ejaculate from affected individual varies from 10 to >50% [3]. When pyriform defects are in high numbers, their impact on fertility has been documented in both in vivo and in vitro studies. Thundathil et al. [39] reported that in vitro fertilization rates were lower for semen containing high numbers of pyriform heads than for ejaculates containing low numbers, 68.5 versus 84.4%, respectively. Sixty-day pregnancy rates in estrus-synchronized artificially inseminated heifers using semen from these same bulls were 37 and 61%, respectively, for bulls with pyriform sperm and the control bull. In the same study, rates of embryo/fetal loss

Sperm Morphology of Domestic Animals, First Edition. J.H. Koziol and C.L. Armstrong.

Companion website: www.wiley.com/go/koziol/sperm

between rates of embryo/fetal loss between days 22 and 60 of pregnancy were 23 and 8% for the pyriform head group and the control group, respectively [39].

Pyriform sperm disrupt various stages of the fertilization process including: sperm transport, [40–42] oocyte binding and zona penetration, [43] along with postfertilization events [39]. Furthermore, the prognosis for recovery is highly variable among animals. Mature bulls with high levels (25–75%) of pyriform sperm have a poor prognosis for recovery when there is no

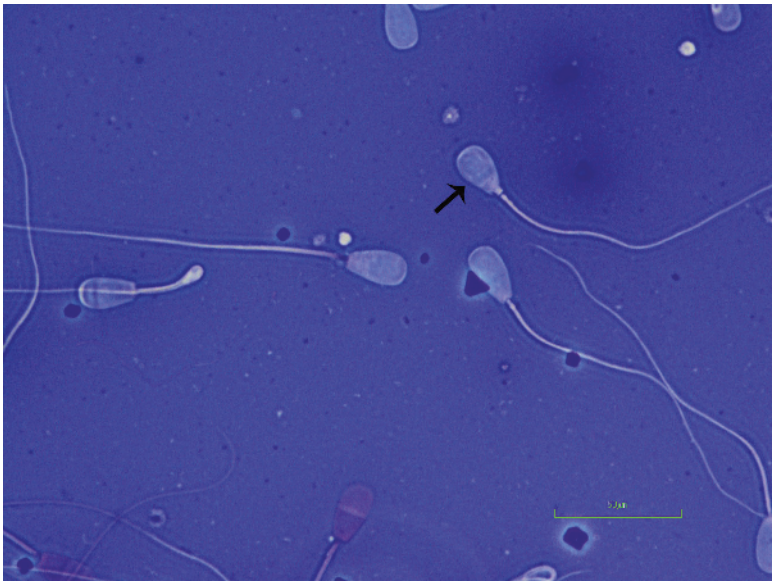

Figure 1.1 Pyriform head in a bull (eosin–nigrosin, 1000×).

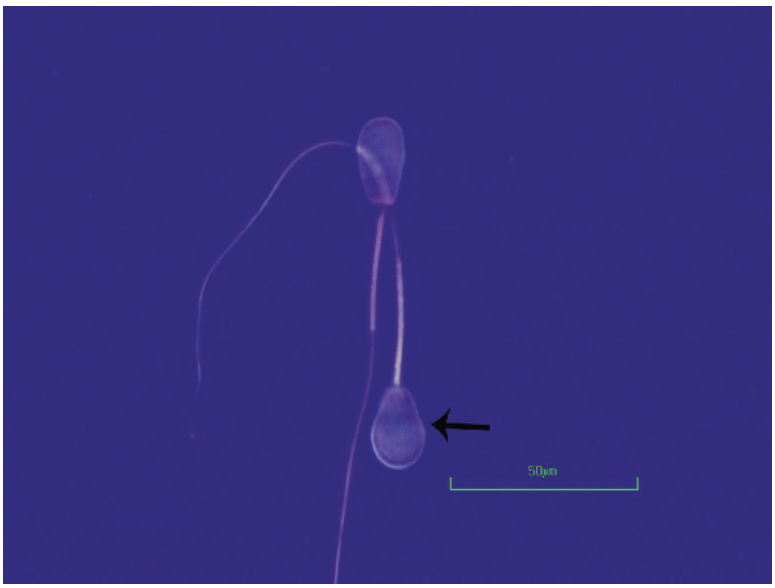

Figure 1.2 Pyriform head in a bull as indicated by arrow (eosin–nigrosin, 1000×).

apparent reason for a disturbance of spermatogenesis [21]. Return to normal sperm production by bulls known to have suffered an adverse condition predisposing them to disturbed spermatogenesis is dependent on the severity and duration of the insult. Younger overconditioned bulls often produce an ejaculate with a high level of pyriform heads and recover after weight loss [3].

In stallions, Jasko and Love both noted a negative correlation between the percentage of sperm head defects and fertility [32, 33]. Jasko et al. noted that head defects accounted for the large proportion of variation in per cycle pregnancy rates [33]. Love et al. similarly noted that a 1% increase in percentage of head defects resulted in a 0.67% reduction in per cycle pregnancy rates.

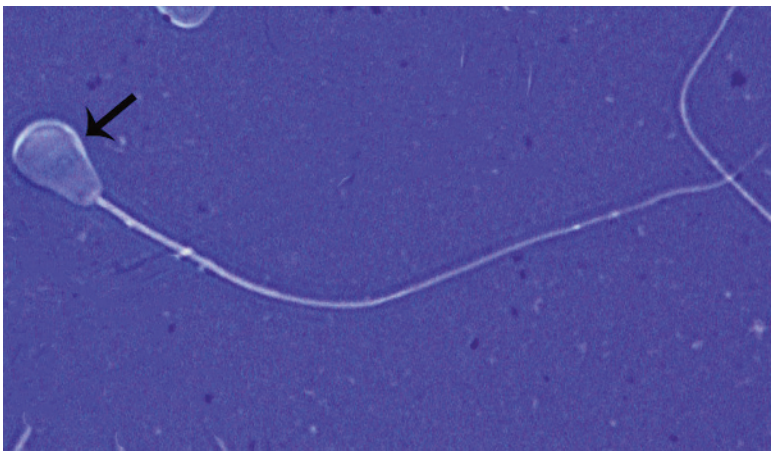

Figure 1.3 Pyriform head in a bull as indicated by arrow (eosin–nigrosin, 1000×).

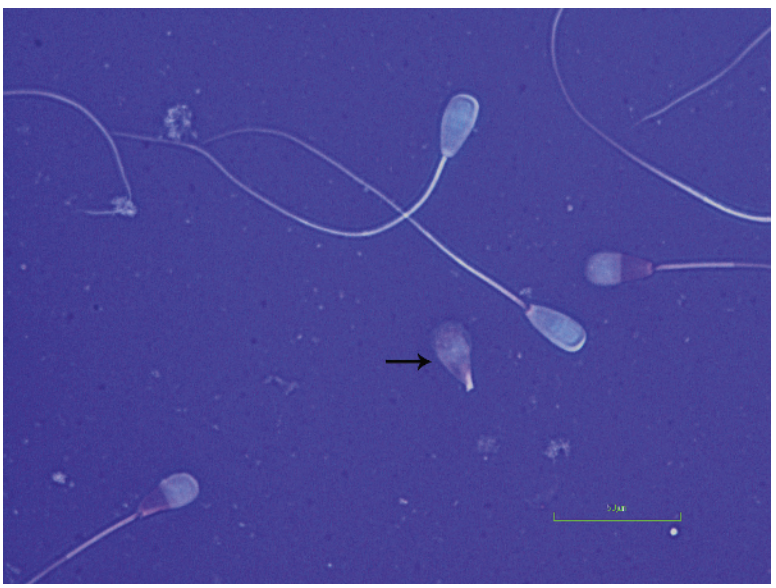

Figure 1.4 Detached pyriform head in a bull indicated by arrow (eosin–nigrosin, 1000×).

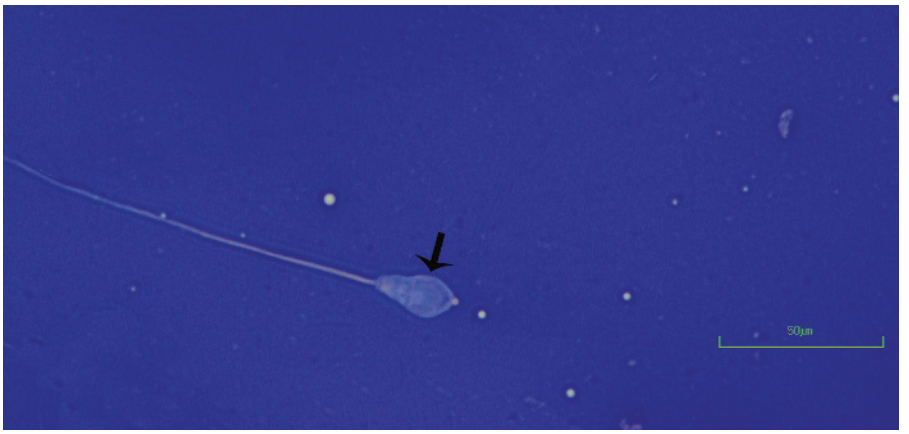

Figure 1.5 Pyriform head in bull as indicated by arrow (eosin–nigrosin, 1000×).

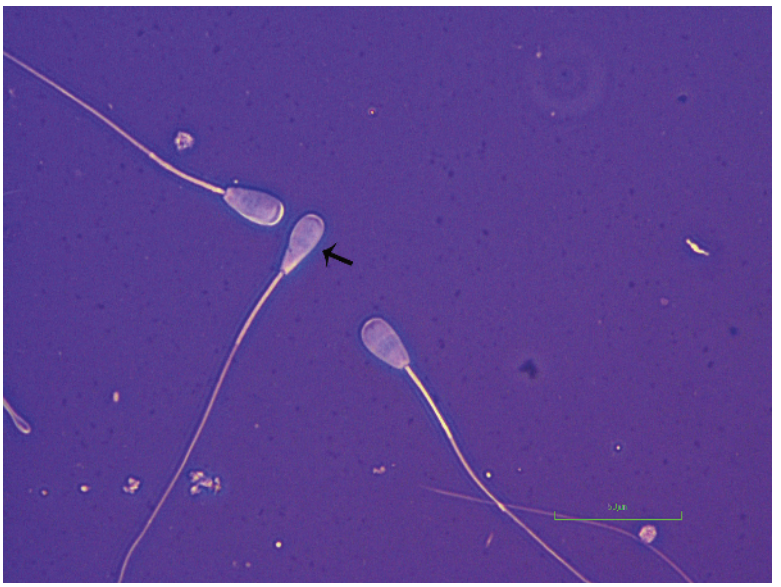

Figure 1.6 Pyriform head in a bull as indicated by arrow (eosin–nigrosin, 1000×).

Figure 1.7 Pyriform head in bull as indicated by arrow also note the proximal droplet and terminally coiled tail (eosin–nigrosin, 1000×).

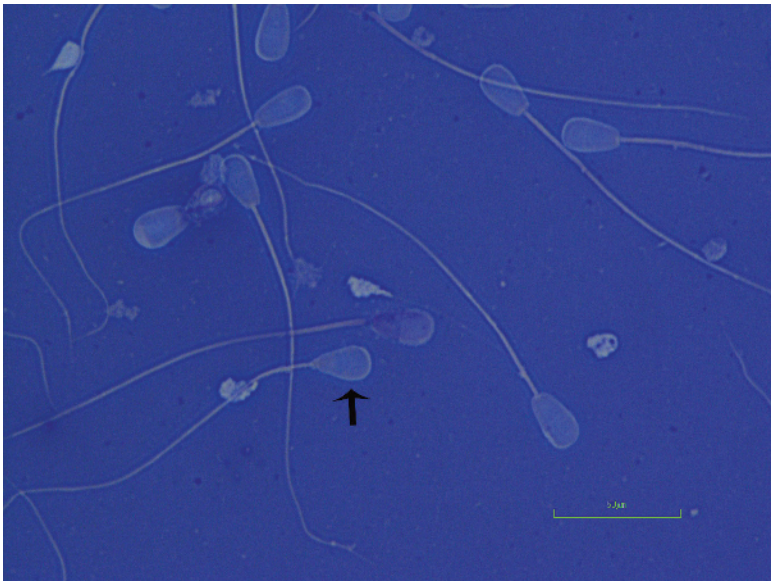

Figure 1.8 Pyriform head in a bull (eosin–nigrosin, 1000×).

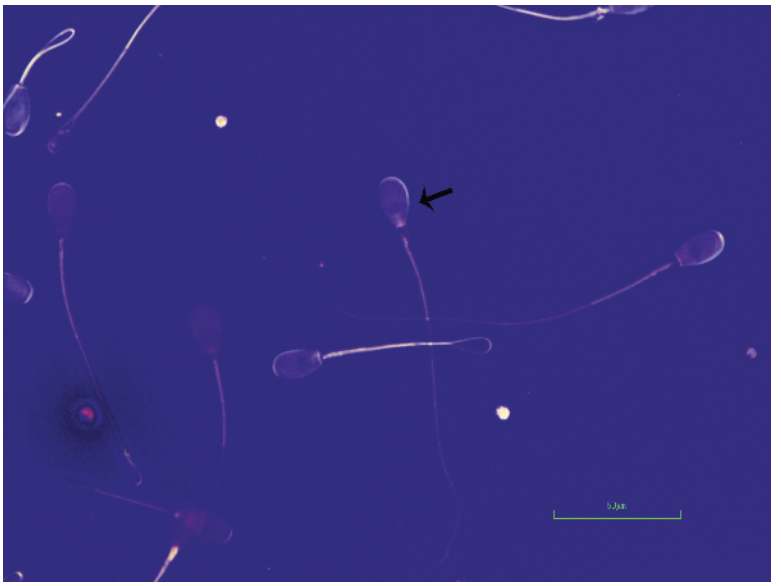

Figure 1.9 Pyriform head in a ram (eosin–nigrosin, 1000×).

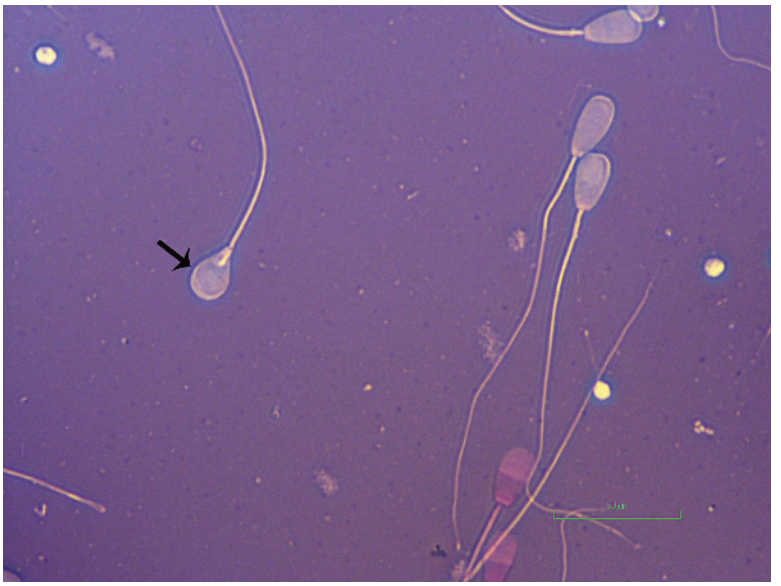

Figure 1.10 Pyriform head in a bull (eosin–nigrosin, 1000×).

Figure 1.11 Pyriform head defect in a bull as indicated by arrow compared to normal-shaped head as indicated by star (eosin–nigrosin, 1000×).

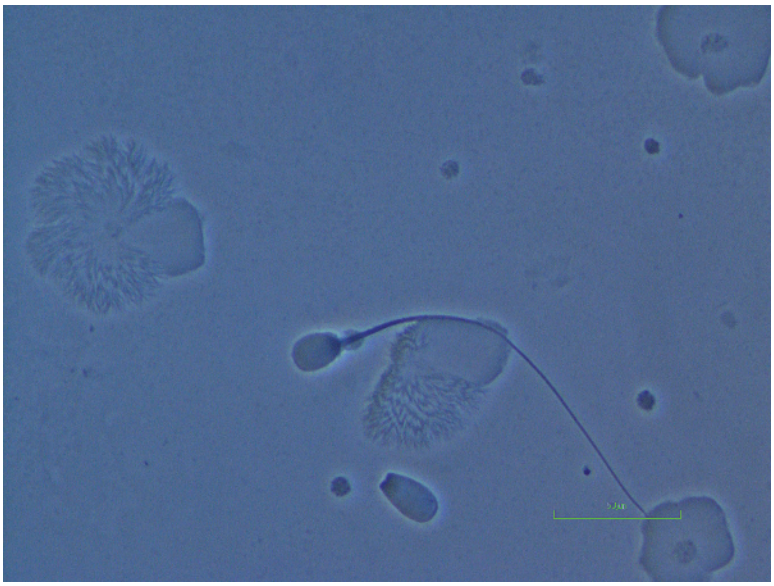

Figure 1.12 Pyriform-shaped head in a bull with proximal droplet (phase contrast wet mount, 1000×).