CONGENITAL AND DEVELOPMENTAL ANOMALIES OF THE GENITALIA OF SLAUGHTERED BULLS

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SUMMARY: The genital tracts of 968 slaughtered bulls (46% of which were young post-puberal animals) were examined for defects of a congenital or developmental nature. The overall occurrence of such lesions was 7%. These comprised persistent penile frenulum (0.5%), hypospadias (0.3%), detached urethral process (0.4%), testicular hypoplasia (0.2%), cryptorchidism (0.6%), mesonephric duct abnormalities (1.1%) and bulbourethral cysts, fusion and aplasia (3.6%). Segmental aplasia of the mesonephric duct, not previously recorded in the study area, was found in 4 Shorthorn bulls (0.4%); 2 affected animals were from one herd. In 3 cases of hypospadias (2 from one herd), the urethra communicated with the ventral surface of the penis at the junction of the body and glans through a slit-like orifice. The occurrence of defects observed was generally comparable to that found in bull populations elsewhere but elevated occurrence of several defects in particular herds emphasized the need for further study.

Introduction

Little information is available in Australia on the occurrence of congenital defects of the genital tract of the bull. As some of these anomalies may be inherited their identification is of obvious importance.

A previous survey in northern Australia involved mostly mature and old bulls (Ladds et al 1973, Mosaheb and Ladds 1973, Bagshaw and Ladds 1974). It was felt that these studies did not accurately reflect the incidence of congenital abnormalities and for this reason a further study was carried out concentrating, wherever possible, on young bulls submitted for slaughter.

Materials and Methods

The external and internal genitalia collected at slaughter from 968 bulls derived from 24 herds in north Queensland and the Northern Territory were examined. Herds were selected at random and the histories of bulls were unknown. Young bulls (all post-puberal) were of primary interest, although older bulls present in the same draft were also examined. The approximate ages of bulls were estimated from the teeth at slaughter; these were 9 months to 3 years — 46%, 3½ to 7 years — 29% and more than 7 years — 25%. The survey was made during the period May to November, 1975.

Visual examination was made of the prepuce and scrotum and the penis was then extruded and examined. The testes were exposed in situ by reflecting the scrotal skin and fascia on the posterior aspect. The orientation of each testis was examined before the tunics were incised and each testis removed for closer study. The epididymis and vas deferens were closely examined and a longitudinal incision made through the epididymis into the body of the testis to expose the rete and mediastinum. The internal genitalia were examined grossly as described by Bagshaw and Ladds (1974). All anomalies were recorded and photographed and where appropriate, blocks were fixed in 10% buffered neutral formalin or Bouin’s fluid for histological study. Lesions which were obviously not congenital or developmental were disregarded.

Results

The overall incidence of lesions was 7%. The results of the gross examination of the genitalia are summarized in Table 1.

Persistent Penile Frenulum

Of the 5 cases detected, 2 originated from the one herd. In 4 bulls the frenulum was attached in the region of the galea penis while in 1 bull it attached approximately 9 cm caudal to that region. On histological examination all frenula were traversed by at least one muscular artery.

Hypospadias

In the 3 cases found (2 from one herd), the urethra opened onto the ventral aspect of the penis at the junction of the body and the glans (Figure 1). The urethral openings were from 5 to 7 mm long x 1 mm in width.

Detached Urethral Process

In 4 bulls, (3 from one herd), the urethral process was found to be detached from the rest of the free end of the penis giving it a bifid appearance.

Hypoorchidism

In 2 of the 5 bulls affected 1 testis was absent from the scrotum and was not located elsewhere at slaughter. These animals were assumed to have been incompletely castrated, possibly because of

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TABLE 1

Occurrence of Anomalies of the Genitalia Detected after Slaughter of Bulls in Northern Australia

<table>
<thead>
<tr>
<th>Item</th>
<th>Number</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulls examined</td>
<td>968</td>
<td></td>
</tr>
<tr>
<td>Penis and prepuce</td>
<td></td>
<td></td>
</tr>
<tr>
<td>persistent frenulum</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>hypospadias</td>
<td>3</td>
<td>0.3</td>
</tr>
<tr>
<td>detached urethral process</td>
<td>4</td>
<td>0.4</td>
</tr>
<tr>
<td>Testis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hypoorchidism</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>cryptorchidism</td>
<td>6</td>
<td>0.6</td>
</tr>
<tr>
<td>Mesonephric duct structures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>spermatic granuloma</td>
<td>7</td>
<td>0.7</td>
</tr>
<tr>
<td>segmental aplasia</td>
<td>4</td>
<td>0.4</td>
</tr>
<tr>
<td>Bulbourethral glands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cysts</td>
<td>14</td>
<td>1.4</td>
</tr>
<tr>
<td>fusion</td>
<td>21</td>
<td>2.1</td>
</tr>
<tr>
<td>aplasia</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>7.0</td>
</tr>
</tbody>
</table>

Incomplete descent of the small testis at that time. The condition was unilateral in all bulls (3 left, 2 right); there was no evidence of adhesions within the scrotum.

On the basis of gross and histological findings a diagnosis of testicular hypoplasia was made in 2 of these bulls; testicular degeneration was considered the cause of hypoorchidism in the remaining 3.

Cryptorchidism

Involvement in all 6 cases was unilateral. The retained testis was located in the abdomen in 5 bulls while in the remaining bull it was found on the left side at the external inguinal ring. Two affected bulls were from the same herd.

Spermatic Granuloma

In the 7 cases encountered (5 from one herd), 6 were in the head of the epididymis — 2 bilateral, 2 left- and 2 right-sided. The remaining case was in the epididymal tail on the left side. Lesions varied from a small cyst 0.5 cm in diameter within the epididymal parenchyma to involvement of the entire head.

Microscopically, in 1 case, intra-epithelial cysts were seen in the ductular epithelium. In 1 young bull histological findings suggested that occlusion of the left epididymis had resulted from spermatic granuloma.

Segmental Aplasia

Of the 4 bulls — all Shorthorns — in which segmental aplasia (SA) of the mesonephric duct was diagnosed, 2 were from the same herd. Details of findings in affected animals are shown in Table 2.

In bull 2, a small cyst 5 mm in diameter located in a strand of connective tissue on the posterior aspect of the testis was the sole remnant of the vas deferens. In bulls 2 and 4, cysts approximately 2 cm in diameter, filled with gelatinous material were present in the seminal vesicle on the affected side and in one of these cases (bull 4) the corresponding ampulla was also cystic. In all cases, the testis on the affected side was more turgid and resilient than the opposite testis.

Microscopically, changes in affected mesonephric duct structures were characteristic (Blom and Christensen 1951). Affected testes in the 4 bulls revealed a varying degree of degenerative change. In all cases these changes were most pronounced in the proximal testis and diminished in severity towards the distal pole. No relationship between type and severity of lesion and age, was apparent.

In all bulls the opposite testes and associated internal genital structures were grossly and histologically normal.

Bulbourethral Cysts, Fusion and Aplasia

Cysts were bilateral in 3, and left- and right-sided in 7 and 3 bulls, respectively. In one other bull, location of cysts was not recorded. Cysts ranged in diameter from 0.5 to 1.5 cm, and all were filled with a translucent, viscoid fluid.

The single case of bulbourethral aplasia detected, involved the left gland.

Discussion

Under conditions of extensive management of beef cattle, where little or no record of reproductive performance of bulls is kept, defects of the
genitalia — congenital or acquired — are likely to escape notice. The present study reinforced and extended findings of an earlier survey (Ladds et al 1973, Mosheb and Ladds 1973, Bagshaw and Ladds 1974), particularly in regard to those defects which are congenital and may be inherited.

Hypospadias was reported by Wollrab and Rechenberg (1964) to occur most often in goats and sheep and only infrequently in the bull. Their review of the literature cited 4 cases and we found only 2 other reports of hypospadias in surveys by Carrol et al (1973) and Greene et al (1973) in which a further 17 and 2 cases respectively, were detected. These reports included no morphological descriptions of the defect. In the present study 0.3% of bulls were involved and it seemed unlikely that fertility would have been adversely affected. Hypospadias is considered the mildest form of pseudohermaphroditism (McFarland 1958) and, in man, it is sometimes familial (Willis 1962).

Ashdown (1957) described an abnormality in a steer in which the urethral process was separated from the free end of the penis. He suggested the defect was congenital and might also be found in the entire bull. Our finding of 4 bulls with “detached urethral process”, with no evidence of trauma to the penis, supports Ashdown's suggestion.

The finding of abdominally located testes in 5 of 6 bulls with cryptorchidism is at variance with the observation by Blom and Christensen (1947) that in cattle, undescended testes are most often inguinal.

Cryptorchidism is generally considered to be genetically determined although, in cattle, available evidence is inconclusive. Wheat (1961) described 4 cases of left-sided cryptorchidism in related Hereford bulls (father, 2 sons and a grandson) and suggested that a dominant gene with variable expressivity was involved.

In a survey of over 2000 young bulls, Blom and Christensen (1960) found an overall incidence of spermatocele and spermatic granuloma of 2.7%—considerably higher than in the present study (0.7%), or in an earlier survey (Ladds et al 1973). Blom and Christensen (1960) considered that the lesion they observed arose from sperm accumulation in rudimentary blind tubules — the aberrant ducts — in the epididymal head, followed by degenerative changes in the ductular epithelium. They also stated that the condition might be hereditary. Spermatic granuloma in the epididymal head in Saanen goats was observed by Soller et al (1969) to be associated with partial penetrance of the dominant gene for polledness. Because of the probable heritability of spermatic granuloma and its potential to impair fertility,
genetic aetiology. In man, congenital malformations of segments of the ductal systems of the male genital tract are no longer considered rare (Amelar and Hotchkiss 1963), and a significant association has been found between such malformations and cystic fibrosis, an autosomal recessive disorder (Ladds et al 1973, Bagshaw and Ladds 1974). The gross and histological findings in affected bulls in the present study correspond to the comprehensive descriptions given by Blom and Christensen (1947, 1951, 1972) and Konig (1964).

Although Fluge and Loliger (1963) postulated an infectious/inflammatory basis for SA, it is now evident that this condition is inherited — probably in a recessive manner involving genes from both parents (Konig et al 1972, Ostrowski 1972). Similar findings in the mink (Blom and Hermansen 1969), in which the condition is usually unilateral, offer strong support for a genetic aetiology. In man, congenital malformations of segments of the ductal systems of the male genital tract are no longer considered rare (Amelar and Hotchkiss 1963), and a significant association has been found between such malformations and cystic fibrosis, an autosomal recessive disorder involving the exocrine glands (Holsclaw et al 1971).

In the bull, bilateral cases of SA are sterile and therefore self-limiting. Unilateral cases, however, may transmit the defect since affected bulls are fertile.

In the present study, the occurrence of congenital defects of the genitalia was, in general, comparable to that found in bull populations elsewhere. Our findings of apparently inherited defects such as testicular hypoplasia and epididymal aplasia, in several bulls from particular herds, however, again underline the need for further detailed investigations to elucidate the nature and transmission of these and other abnormalities.

Acknowledgments

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