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CLINICAL, ENDOCRINOLOGICAL AND HISTOPATHOLOGICAL EVALUATION OF CASTRATION IN BULLS

(With 5 Tables and 16 Figures)

By

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(Received at 27/6/1996)

التقييم الاكلينيكى والهرمونى والنسجوباثولوجى للخصى فى العجول

ابراهيم حسين ، نشأت صالح ، سيد عطالله ، حمدى فتيح ، اميمة عزو

اجرى هذا البحث على ثلاثون عجل بقرى تتراوح اعمارهم بين ١٢-١٨ شهرا فى مزرعة كلية الطب البيطرى جامعة قناة السويس. تمت عملية الخصى بالطريقة الغير دموية فى عشرون عجلا بينما اجرى الخصى بالطريقة الدموية القياسية فى خمسه حالات والخصى بأزالة كيس الصفن والخصيتين فى خمسة حالات أخرى. ولقد ثبتت الدراسة أن الطريقة الاخيره هى الاصلح لتفادى المضاعفات التى قد تحدث عند استخدام الطرق الأخرى. بينما تفضل الطريقه الغير دموية فى حاله خصى اعداد كبيره. وأثبتت الدراسة وجود نقص ملحوظ فى حجم الخصية ابتداء من اليوم الخامس عشر بعد الخصى وذلك من خلال القياسات والفحص الباثولوجى الظاهرى. كذلك اثبتت الدراسة عدم وجود اية قياسات لمستوى هرمون التستوستيرون فى مصل الدم ابتداء من اليوم السابع بعد الخصى بغض النظر عن الطريقة المستخدمة فى طريقة الخصى. اوضح الفحص الباثولوجى الظاهرى للخصية فى الحالات التى تم خصيها بالطريقة الغير دموية زيادة فى الحجم خلال الاسبوع الاول ، تبع ذلك تناقص مضطرد فى الحجم الى ان وصلت لحجم صغير مساو لقطر الحبل المنوى بعد سبعون يوما. كما لوحظ تحول اللون الى الاصفر الرمادى الفاتح فى المراحل الاخيرة مع تصلب فى القوام. وبالفحص المجهرى فى المراحل الاولى وجد احتقان شديد مع انزفة وارتشاح سوائل يعتقد انها سبب زيادة الحجم. بعد ذلك اخذت الانابيب المنوية فى التدهور والتحلل مع حدوث غزو للخصية بالانسجة الليفية الضامة. وبالنسبة للغدد التناسلية الثانوية حدث بها ضمور شديد مع تغير فى الشكل والحجم الظاهرى. وبالفحص المجهرى وجد تليف يحيط بالكيسات الغدية مع فقدان فى نشاطها الافرازى. وجدت هذه التغيرات على مدار مدد مختلفة عقب الخصى باستخدام كلا من الطريقتين الدموية والغير دموية.

SUMMARY

Thirty healthy bulls of ages between 12-18 months were used in this study to evaluate three surgical techniques of castration from the clinical, endocrinological and histopathological points of view. Twenty bulls were conventionally castrated by Burdizzo's bloodless technique, 5 bulls by the standard-open technique and 5 bulls castrated by complete ablation of the scrotum and testes. Castration and ablation of the scrotal sacs have had many advantages over other techniques. On the other hand bloodless castration was found to be easy to apply and appeared suitable for large scale program in bulls. A reduction in the testicular volume was started 15 days postcastration as detrmined by calibration as well as the gross pathological examination. By the 7th day postcastration no detectable testosterone was measured regardless to the method of castration. After bloodless castration, gross examination of the testes revealed an increase in size during the first week, followed by progressive decrease until became equal in size to the spermatic cord at the 70th day postcastration. Decrease in the intensity of colour and increase in the firmness occured parallel to the decrease in size. Histologically, there was congestion , edema and hemorrhage of the testicular tissue in the first week. Thereafter, the seminiferous tubules showed necrosis and the testicular tissue was invaded by granulation tissue, with increasing severity up to the 70th day postcastration. Starting from the 35th day postcastration the accessory genital glands shwoed atrophy, loss of the secertory activity and fibrosis, with changes in shape and size, regardless to the method of castration. By 60 days postcastration a marked decrease in the mean weight of the seminal glands and bulbourethral glands was found.

Key words: *Bulls-Castration-Changes-Evaluation*

INTRODUCTION

Castration is a common procedure in many foodlot animals. Bovine castration is an old practice used primarily to produce an animal that will fatten better into higher quality meat. Also steers are much easier to mange than bulls. In addition, not only castration practiced in ruminants in diseased conditions like scrotal hernia, hydrocele and testicular neoplasms but also used to prevent breeding. There are many techniques used for castration of bulls such as bloodless technique using burdizzo castrator or elastic ring slipped over the base of the scrotum, removal of testicles (Hickman and

Walker, 1980; Venugopalan, 1982; Cohen et al., 1990); partial castration in which the parenchyma of the testis expressed from the testicular capsule (Baibutcjan, 1961; Wawrzynczak, 1965; Semprini, 1964, Robertson, et al., 1967, and Shokry, et al., 1984); a chemical castration (Bierschwal and Ebert, 1961 and Freeman and Coffey, 1973); immunological castration by LHRH antibodies (Robertson et al., 1979 and 1981) and complete ablation of the scrotum and testicles (Misk, 1982 and 1987).

Although it is generally accepted that the endocrine function of the testis is a major factor influencing the male reproductive activies (Linder and Mann, 1960. Arthur, 1979. Bearden and Fuquay, 1980) . There are no extensive data concerning how raqidly and to what extent castration can adversely affect the normal reproductive functions in the male animal (Clemens and Christensen, 1975 and Abdou et al., 1984).

Also, there is a great dearth of informations, particulary from the histopathological point of view, about the chronological changes and the fate of the testis as well as the accessory sex glands after castration. Robertson, et al., (1981) described the histological appearance of the testis after the immunological castration only where there was arrest of spermatogenesis in most of the tubules and atrophy of few tubules. The castration by this method is considered temporary and the animals return fertile after a period of functional castration. Eissa (1980) and Abdou et al. (1984) described the histological picture of the accessory genital glands of buffalo bulls 7 weeks after castration and reported the atrophy of the secretory epithelium and fibrosis of the glands specailly the prostate gland. A little was mentioned by Bagshaw and Ladds (1974), Humphrey and Ladds (1975), Weaver (1986), Bacha and wood (1990), McEntee (1990) and Jubb, et al. (1992) about the testicular necrosis and atrophy of the accessory sex glands in different animals as a result of castration.

Therefore, the present study was performed for studying the clinical, endocrinological and histopathological alterations in the testes and the accessory genital glands after castration by using both standard-open and bloodless methods in bulls.

MATERIAL and METHODS

Thirty healthy bulls ranging in age between 12-18 months and weighing from 250 to 300 kg were used for the present study. These animals were born in the faculty farm belonging to Suez Canal University. Before surgery, each animal was examined to confirm the presence of both testicles. The bulls were then divided into two main groups:

Group I: Comprised 20 bulls: Conventionally castrated using Burdizzo's method (bloodless method).

Group II: Comprised 10 bulls: divided into 2 subgroups subgroup II-A: 5 bulls castrated using standard open covered method (removal of the testicles) (Venugopalan, 1982).

Subgroup II-B: 5 bulls castrated using complete ablation of the scrotum and testicles (Misk, 1982 & 1987).

Anaesthesia and control:-

All operations were performed with the animals in lateral recumbency with the upper limb pulled and secured in flexion forward to expose the testes.

All animals of group I were operated without using chemical restraint drugs and thsoe of group II were sedated with xylazine (Rompun, Bayer) given intramusclarly at a dose rate of 0.10 mg/kg b.w.

In subgroup II-A, the scrotum was analgesied by direct subcutaneous infiltration along the line of incision using about 5 ml of a 2% solution of lidocaine Hcl (xylocaine Hcl, Astra-Sweden). The testis was blocked by injecting the spermatic cord where it enters the superficial inguinal ring using about 5ml of xylocaine Hcl 2%. In subgroup II-B, the local analgesic agent was infiltrated around each spermatic cord and also around the base of the scrotum.

Surgical procedures:-

Group II-A: The surgical site was prepared for aseptic surgery. A skin incision was paralled and equidistant from the median raphe along the wheal of local analgesic. This incision extended from the junction of the middle and distal thirds of the posterior aspect to the anterior one of the testis, through the dartos but not the tunica vaginalis. The testis within the tunica vaginalis was bluntly dissected free from the scrotal fascia to expose the spermatic cord. The spermatic cord, covered by vaginal tunic, was then crushed at its proximal part with a sand crusher for about 20 sec. A ligature of chromic catgut No 2 was applied at the crush site. The spermatic cord was transected 1-2 cm distal to the ligature by using an emasculator and the stump checked

for bleeding. The opposite testis was removed in a similar manner. A mixture of antibiotics powder was administered at each scrotal sac.

Group II-B: After preparation and drapping the surgical site, a circular incision was made at the base of the scrotum, through its all layers. The spermatic cord on each side and the associated intact parietal layer of tunica vaginalis were bluntly dissected from the scrotal septum. The scrotal septum was severed after crushing of its blood vessels. Each spermatic cord was followed upward to the external inguinal ring and crushed 1cm from it. A chromic catgut ligature was placed over the crushed area. The cords were emasculated 1-2 cm distal to the ligature (Fig. 1). The surgical wound was closed in a simple continuous pattern in the subcutaneous tissue. Silk sutures were used in a simple interrupted pattern in the skin. Antiseptic dressing, local and systemic antibiotics were not adminstered to all animals of this group. Sutures were removed seven to ten days later.

Management:- The animals were reared intensively and fed ad libitum on balanced diet according to Ensminger and Olintine (1978) for 120 days.

Clinical observattion:- All animals were closely observed, specially at the first few days following surgery to record the picture of the surgical site as well as any post- operative complication. In addition, the testicular volume was measured according to Osman (1970) in 6 bulls randomly taken from the group I by a caliber where the length, width and thickness was multiplied by 0.52. Testicular volume was calculated before castration and at 3, 15, 30, 45 and 60 days post-castration.

Blood serum testosterone profile: Blood samples were taken once weekly from 10 cases, 6 bloodless castrated animals from group I and 4 open-castrated animals from group II, precastration as well as up to 30 days postcastration. After centrifugation of the collected blood at 3000 for 15 minutes, serum was separated and kept at -20C till assay. By the double antibody radioimmunassay technique, testosterone profile was measured in the serum (Abraham, et al., 1977).

Gross and histopathological examination:- Testis, epididymis and vas deferens were dissected through a surgical castration of 8 cases from group I, at period of 3, 7, 14, 21, 28, 50, 60 and 70 days postcastration (bloodless method). The gross changes in size, colour, and consistency of the testes and the spermatic cord were recorded and samples for histopathlogical examination were taken. After slaughtering 6 out of these 8 animals, the accessory genital glands were removed and examined for the gross and histopathological changes. The time elapsed between castration and slaughtering was 28, 35, 50, 60, 95 and 120 days. In addition, the accessory

genital glands were obtained from 6 animals of group II after the same periods postcastration for the same purpose. Samples for histopathological examination were taken and immediately fixed in 10% neutral buffered formalin for 24 hours, then washed, dehydrated, embedded in paraffin wax and sectioned at 4-5 microns. The tissue sections were stained by H&E and Von Kossa stain for calcium (Drury and Wallington, 1980). The accessory genital glands of 3 bulls (12-18 months old) were collected from the slaughter house as control. They were compared to the accessory genital glands of 3 animals from group I and those of 3 animals from group II that were obtained 60 days postcastration, regarding the changes in their weight. The accessory genital glands including the seminal glands, ampullae, prostate and bulbourethral glands were removed, dissected from extraneous tissues and weighed immediately after slaughter to detect the changes in weight.

RESULTS

Clinical observation:

Group I (bloodless castration) Signs of discomfort were observed at the first 2 weeks postcastration in all animals of this group. Palpation of the testis revealed a soft consistency and enlargement in size at the first few days which subsided at the end of the first week. The scrotum of 19 animals (out of 20), did not exhibit any visible external changes, while the scrotal sac of only one animal appeared spherical in shape, tense in consistency and its distal half discoloured into pink at the 3rd day postcastration. There was a sharp line of demarcation between the upper and lower halves of the scrotum. This line represented the site of cruching (fig. 2). Two weeks later, the scrotum became dark brown and hard in consistency. Castration by total ablation of the scrotum and testicle (after Misk, 1982) was suggested as a radical treatment of this case.

As shown in table (1) and fig. (3) marked reduction in the testicular volume started by 15th day postcastration onwards.

Group II: subgroup II-A (standard-open covered castration): All animals recovered without any complications. The scrotum of all animals appeared oedematous at the first few days postoperation without evidence of any exudation from the scrotal wound (fig. 4). Complete healing of the scrotal wound was obtained about one month postoperatively and appeared as a skin fold. Subgroup II-B: Complete ablation of the scrotum and testicle. All animals of this group recovered without any complications. Even at the first

few days postoperatively, there was no edema at the surgical site (fig. 5). Healing by the first intention was completed within 10 days (fig. 6).

Blood serum testosterone profile:

It was evident that regardless of the method of castration, no detectable testosterone was measured at 7th day PC. Before castration, the mean serum level of testosterone in native bulls was 2.12±1.07 ng/ml and 1.37±0.45 ng/ml for animals castrated by bloodless and open methods, respectively.

Gross and histopathological changes:

A. Testes of castrated animals by bloodles method:

On day 3 postcastration (PC), the testes were soft in consistency, slightly enlarged in size and the sagital section showed dark red discolouration of the testicular tissue and reddish black clotted blood in the testicular blood vessels just distal to the cruched area (fig. 7). Microscopically, there were severe congestion of the large blood vessels and capillaries, large areas of haemorrhages and edema in the testis, specially in the deeper part of the tunica albouginea. The seminiferous tubules contained numerous spermatoza mixed with amorhpous esinophilic substance. The cellular details of the spermatogenic cells and interstitial cells were still seen. The epididimis was congested and infiltrated with leukocytes mainly macrophages, plasma cells and some polymorphs. The lining epithelium of the epididymis and vas deferns was intact and appeared normal.

On day 7 PC, the colour of the testicular tissue was brick red with less intensity than that noticed on day 3 PC. The testicular tissue was also soft than of the day 3 PC. Microscopically, there were severe dilatation of the blood vessels and lakes of haemorrhagic blood at the line of cruching and surrounding area. Under the cruched part on the testicular side, there was intensive granulation tissue formation. The large blood vessels showed sever vasculitis. Some vessels were infiltrated by mononuclear leukocytes with edema and narrowing of the lumen. Other vessels were invaded by the granulation tissue of the surrounding area with oblitration of the lumen. The tunica albuginea and the underlying testicular tissue were severely congested with perivascular hemorrhage. There was marked edema in the interlobular spaces and septula testis (fig. 8). Leukocytic infiltration of the interstitial tissue and the outer capsule was also noticed. The spermatogenic cells showed loss of cellular details and staining affinity of the nuclei in an increasing degree from the periphery towards the center of the tubules. The interstitial cells were also necrosed. No changes occured in the epithelium of the epididymis but its contents seemed to be concentrated and adhered to one side.

On day 14 PC, the testes were smaller in size, the consistency tended to be harder and the colour became bright red. Microscopically, there was complete coagultive necrosis of the intersitial cells and seminiferous tubules except those present just under the tunica albuginea that showed some cellular details. The tubules exhibited irregular outlines and slight shrinkage (fig. 9). Their luminal content were aggregated and clumped. Blood vesseles of the tunica albuginea were engorged with normal blood. The previously mentioned granulation tissues seen on day 7 PC showed more progression and extension towards the testis and towards the line of crushing. The tissue of the epidydimis was still normal but some epithelial cells showed vacuolation at their bases. There was focal aggregation of plasma cells and lymphocytes around the duct.

On day 21 PC the testicular tissue became light yellowish brown and the size more smaller (fig. 10). There was marked engorgment of the testicular blood vessels as well as the blood vessels of the deeper part of the tunica albuginea with clotted blood. Microscopically, most of the large blood vessels became occupied by a mass of granulation tissues. The granulation tissues began to invade the tunica albuginea. All seminifereous tubules were necrotic and shrunken leaving a hollow spaces around them. More degeneration was noticed in the epithelium of the epididymis (fig. 11).

On days 28, 50 & 60 PC the testicular tissue became pale grayish red in colour with blackish areas of previous haemorrhage. There was a marked reduction in size of the testes and thickining of the tunica albuginea (fig. 12). On day 28 PC microscopical examination revealed invasion of the necrotic tubules by granulation tissue, namely in the intertubular speces. This was accompanied by numerous polymorhps and some mononuclear cells. The necrotic tubules began to be fragmented. More degeneration and narrowing of the duct of the epididymis was observed.

On day 50 PC, there was deeper extension of granulation tissue in the testis, intertubular and intratubular. The old granulation tissue becme mature with more collagen and few narrow capillaries. On day 60 PC all the semineferous tubules became invaded and surrounded by granulation tissue. The epidydemis showed more atrophy with fibrosis, necrosis of the epithelium and infiltration with leukocytes.

On day 70 PC most of the testicular tissue was fibrosed, firm in consistency and its colour became pale yellow. The size of the testes was greatly reduced (fig. 12). Microscopically, recanalization of the previously thrombosed blood vessels began to occur. Also, many blood capillaries of the granulation became dilated and filled with normal circulating blood (fig. 13).

The necrotic tubules and interstitial tissue fused in a structurless mass. Staining of tissue sections with Von Kossa stain proved the deposition of calcium.

B. Accessory genital glands of the casterated animals by bloodless and open methods:

The accessory genital glands of all examined cases were progressively decreased in size with the increase of the time ellapsed after casteration. These glands became hard in consistency with deformity of the normal appearance. The seminal vesicles lost its specific lobulation and changed into a cord-like structure (fig. 14). A significant reduction in the mean weight of the seminal glands and the bulbourethral glands was found 60 days PC in both techniques of castration (tables, 4 and 5).

Microscopical findings:

1. Ampullae: On day 28 PC the diameter of cross section of the ampulla was markedly decreased in comparison with that of control. There was marked connective tissue proliferation under the tunica muscularis with extension towards the lumen (fig. 15). There was atrophy of the glands indicated by the decrease in their size and number and the height of the lining epithelium. Small amount of secretion was observed in the glands and reminants of spermatozoa were seen in the lumen as dark bluish masses. On days 35, 50, 60, 95 and 120 PC there was more increase of the interglandular fibrous tissue and the degree of atrophy of the gland.

2. Prostate gland: On days 28 and 35 PC, a little changes were observed. On day 50 and 60 PC there was marked interlobular connective tissue proliferation, but the epithelium was not affected. On day 95 the proliferated connective tissue represented about half of the glandular tissue with severe atrophy of the glandular acini and absence of secretion. On day 120 PC, the fibrosis of the gland and the compression of the acini became more pronounced.

3. Seminal vesicles: On days 28 and 35 PC, the connective tissue of the propria submucosa had proliferated and the glands as well as the lining cells decreased in size and number. There was also focal aggregates of inflammatory cells mainly lymphocytes and plasma cells within and outside the glandular acini. On days, 50, 60, 95 and 120 the degree of atrophy and fibrosis increased by time (fig. 16), with accumulation of secretion and formation of corpora amylacea within some dilated acini.

4. Bulbourethral glands: On days 28 and 35 PC little non significant changes were observed. On days 50, 60, 95 and 120 PC the main changes were moderate increase of the interstitium as well as the connective tissue

trabeculae. There was also decrease in the height and secretory activity of the lining cells.

A high significant decrease in the weight of vesicular as well as bulouretheral gland in casterated animals was found (tables 4 and 5).

DISCUSSION

Castration is one of the most common surgical procedures veterinarians are requested to perform on calves. Two forms of casteration are available, bloodless and open surgical ones (Weaver, 1986). Our results were in line with those of Weaver (1986) who stated that application of bloodless casteration in calves appears to cause considerable postoperative discomfort and consequently marked setback to growth. In addition, scrotal skin gangrene is an anticipated complication of the bloodless casteration but they have been rarely reported. This was exactly what happened in one out of the 20 cases operated by this method in the current study. Jennings (1984) and Ramadan and Bolbol (1994) reported that Burdizzo casteration, if it is improperly done, may result in necrosis of the scrotal skin and develops scrotal granulation tissue mass. Therefore, it is important to insure that the minimum amount of scrotal skin is included in the crush and do not form a continuous band around the scrotal neck and also great care must be taken to ensure that the cord is included in the crushed tissues, otherwise the operation will be a failure, and this may not be noticed untill several weeks have ellapsed (Weaver, 1986 and Hickman et al., 1995).

Castration by standard-open method results in an open scrotal sac that can act as a pathway for infection with subsequent development of scirrhous cord and peritonitis. Healing of scrotal wounds after standard castration usually happened by second intention and takes about a month. Therefore it needs close observation and daily management. Our opinion also agree with that of Turner and Mcilwraith (1982) and Misk (1982) who stated that grasping of the spermatic cord may expose it to infection within 5 to 15 days following castration. Exudate may accumulate around the stump of the spermatic cord with standard castration methods.

Castration and ablation of the scrotal sacs have many advantages over the standard second intention healing techniques. The technique is simple and efficient. On the other hand, our results are in support to those of Misk (1982), who reported that incising near the base of the scroutum is an improvement over the standard technique because it prevents tearing of the cord when the testicles are grasped through the ventral scrotal wound. The

possibility of infection is reduced because the operation is performed under aseptic condition. Healing is complete within 10 days. Moreover, scrotal ablation with castration may be the most efficient method for surgical correction of many pathological lesions affecting the testes and scrotum such as orchitis, periorchitis, hydrocele, hematocele and neoplasms (Misk, 1982).

The mean serum levels of testosterone in native bulls before castration were 2.12+ 1.07 and 1.370.45 ng/ml (tables 2 and 3). These obtained values are in agreement with that reported by Abdel-Razek (1989). The undetectable levels of serum testosterone at 7th days following castration by bloodless and bloody methods agree with those estimated by Haynes et al. (1976). Similarly Abdou et al. (1984) indicated that reproductive activity of the male was shortly suppressed PC. Also Cohen et al. (1990) found an immediate decline in plasma testosterone levels in surgically castrated bulls and these levels remained undetectable along a period of 63 days PC. In contrary to the present results, Floman and Yolcani (1966) stated that bull could exhibit sexual interest up to one year PC.

A highly significant reduction ($P< 0.01$) in the mean weights of the seminal glands as well as the bulbourethral glands two months after castration was recorded by the bloodless and open methods (tables 4 and 5). These obtained data are in accordance with those of Abdel-Raouf et al. (1979) and Eissa (1980), who reported that accessory glands weights were markedly reduced in castrated animals. Previously Moore (1939) and Mann and Lutwak-Mann (1951) stated that growth rate, ultimate size as well as the functional activity of the reproductive accessory glands are greatly dependent on testosterone. On the other hand table (1) and fig. (3) showed a marked increase in the mean testicular volume at the 3rd days PC by bloodless method attributed mainly to blood stasis and edema with a gradual decline in the mean testicular volume thereafter. The decline in tesicular volume detected by the measurements and gross pathological examination was due to atrophy of the testicular tissue which finally forms a fibrous knotlike structure approximately equal to the diameter of the spermatic cord as mentioned by Weaver (1986).

On day 3 PC by bloodless method the congestion of the blood vessels, hemorrhages and edema in the testes means sever local passive congestion and could occur due to cut of the venous return while the arterial blood supply still intact. Such changes also explains the enlargement of size of the testis at this time. On day 7 PC, the histological changes indicated complete loss of function of the tubules and interstitial tissue. This was suggested to be the casue of the undetectable testosterone level at the 7th day PC. Such

changes were expected because of the high sensitivity of the seminiferous epithelium to any physical or pathological disturbances (Veeramachaneni et al., 1986). The disturbance in circulation was also the casue of the extensive necrosis happend (Humphrey and Ladds, 1975). This means a quick and permanent castration in contrary to the method of immunlogical castration described by Robertson et al. (1979 and 1981). By time, the blood vessels supplying the testis became all occupied by granulation tissue and the tubules completely necrosed. Lastly the necrotic tubules were invaded by fibrous tissue. On day 60 PC the cruched part and other parts of the spermatic cord as well as most of the testicular tissue were replaced by granulation tissue and this was in agreement with findings of Weaver (1986). On day 70 PC, the testis became a mass of connective tissue underwent new vascularization. It was noticeable that the epididymis was less affected than the testicular parenchyma. Decrease in size of the testes with firmness is known to occur with testicular degeneration (Jubb, et al., 1992). In this study, fibrosis was the cause, specially in the later stages.

The histopathological changes in the accessory genital glands in case of the open and bloodless castration were the same. Generally the glands showed atrophy of the acini with marked fibroplasia and consequent compression and loss of the acini. Grossly, the atrophied glands showed marked decrease in size, deformity in shape and firmness due to the massive fibrosis. The degree of atrophy increased by time as noticed macroscopically and microscopically. McEntee (1990) found that atrophy of the accessory genital glands occurs usually following castration, estrogenic stimulation and advanced testicular degeneration. The seminal glands of the examined cases were the most affected glands, while the bulbourethral was the less affected one. The corpora amylacea seen in the seminal glands are extremely rare in domestic animals and might be due to retained secretion (Jubb et al., 1992). The histological picture of the atrophied seminal glands was nearly similar to that reported in the castrated billy goat by Bacha and Wood (1990). The microscopical changes in the accessory genital glands described in this study were more severe than that described in castrated buffalo bulls by Eissa (1980) and Abdou et al. (1984). This might be happen because of the longer periods after castration where the glands were examined, in addition to the species and hormonal variations.

According to the results of hormonal analysis and pathological examination of the testes and accessory genital glands the bloodless method of castration took a short time to achieve the purpose of castration. There was nearly an equal effect of the bloodless and open methods on hormonal

profile and accessory glands. But major emphasis has been placed on the importance of doing total ablation of the testes and scrotum for castration of bulls to avoid the complications which may result from other methods. On the other hand, bloodless technique was recommended in case of castration on larg scale.

REFERENCES

Abdel Raouf, M. Leouard, J.M. and Paulsen, C.A. (1979): The effect of castration on serum gonadotrophin levels and weights of the pituitary and accessory glands in adult male rats. Egypt. J. Vet. Sci., 16, No. 1, 2, 117-128.

Abdel-Razek, A.KH. (1989): Some studies on the reproductive capacity of bulls in Upper Egypt. M.V.Sc. thesis, Assiut University.

Abdou, M.S.S.; El-Menoufy, A.A.; Badawy, A.B.A. and Hemeida, N.A. (1984): Effect of castration on the reproductive activity of adult buffalo bulls. Assiut Vet. Med. J., 12, No. 33, 203-209.

Abraham, G.; Manlimos, F.S.; Garza, R. (1977): Radioimmunoassay of steroids. In: Hand book of radioimmunoossay, G.E. Abraham Ed., M. Dekkere Inc., New York.

Arthur, G.H. (1979): Veterinary reproduction and obstetrics 4th ed. 424-425. , Bailiere Tindall, London.

Bacha, W. and Wood, L. (1990): Color Atlas of Veterinary Histology. Lea and Febiger. Philadelphia and London.

Bagshaw, P.A. and Ladds (1974): Pathology of the accessory glands of bull. Vet. Bull., 44, No. 6, 343-347.

Baiburtcjan, A.A. (1961): A new method of increasing the reproductivity of livestock (By partial castration). Translated by G.R. Ritchie (1963) in Animal Breed. Abstr. 31, 1-12.

Bearden, H.J. and Fuquay, J.W. (1980): Applied animal reproduction. 1st ed., Restor publishing company, Inc., Virginia.

Bierschwal, D.R. and Ebert, E.F. (1961): Clinical application of a sclerotherapeutic agent. Vet. Med., 56, 323-332.

Clemens, L.G. and Christensen, L.W. (1975): Sexual behaviour. In "The Behaviour of Domestic Animals" 3rd ed. Hafez, E.S. (Editor). Bailliere Tindall, London.

Cohen, R.D.; King, B.; Thomas, L.D. and Janzev, E.D. (1990): Efficacy and stress of chemical versus surgical castration of cattle. can. J. Anim. Sci. 70, (4) 1063-1072.

Drury, A. and Wallington, E. (1980): Carlton's Histological Techniques. 5th ed. Oxford University Press. Oxford.

Eissa, H.M. (1980): Seasonal biological activity of the accessory genital glands of buffalo bulls. M.V.SC. Thesis, Fac. Vet. Med. Cairo Univ.

Ensminger, M.E. and Olentine, C.G. (1978): Feeds and Nutrition. The Ensminger Publishing Company, California, USA.

Folman, Y. and Yolcani, R. (1966): Copulatory behaviour of the prepubertal castrated bull. Anim. Behaviour. 14, 572-573.

Freeman, C. and Coffey (1973): Sterility in male animals induced by in jection of chemical agents into the vas deferens. Fert. Steril. 24, 884-890.

Haynes, N.; Hafs, H.; Purvis, K. and Manns, J.G. (1976): Studies on the effect of unilateral and bilateral castration on plasma testosterone and L.H. Levels in the bull. J. Reprod. Fert. 46, 471-473.

Hickwan, J. and Walker, R. (1980): An atlas of Veterinary Surgery. 2nd ed. The English Language Book society and John Wright and Sons LTD.

Hickman, J.; Houlton, J. and Edwards, B. (1995): Veterinary surgery. 3rd. ed. pp 85-90.

Humphrey, J.D. and Ladds, P.W. (1975): Pathology of the bovine testis and epididymis. Vet. Bull. 45, No. 11, 787-797.

Jennings, P.B. (1984): The practice of large Animal Surgery, Vol. 11, W.B. saunders Co. philadelphia: 1062-1063.

Jubb, K.; Kennedy, P. and Palmer, N. (1992): Pathology of Domestic Animals. 4th ed. Academic Press Inc. New York.

Linder, H.R. and Mann, T. (1960): Relationship between the content of androgenie steroid in the testes and the secretory activity of the seminal vesicles in the bull. J. Endocrin. 21, 341-361.

Man, T. and C. Lutwak-Mann. (1951): Secretory Funtion of the male accessory organs of reproduction in mammals. Physiol. Rev., 31, 27-55.

McEntee, K. (1990): Reproductive Pathology of Domestic Animals. Academic Press Inc. New York.

Misk, N.A. (1982): Castration and scrotal ablation in ruminants. A case report. Mod. Vet. Pract. 63, 637-638.

Misk, N.A. and Seleim, S. (1987): An improved technigue for castrating equids. Equine Practice: 538-541.

Moore, C. (1939): Biology of the testes. Sex and internal secretions. (E. Allen, ed.) 2nd ed. 353-451. The Williams and Wilkins Co., Baltmore.

Osman. A.M. (1970): A.M. (1970): A modified techique used for the clinical evaluation of testicular size in bull. Acta Vet. Scand Sci. Hungaricare Tomus. 20, 149.

Ramadan, R.O. and Bolbol, A.E. (1994): Testicular rupture secondary to blood less castration in a calf. Beni-Suef, Vet. Med. Res., IV, No. (1/1): 154-155.

Roberston, I.S.; Wilson, J.C. and Morris, P.G.D. (1967): Growth in castrated cattle. Vet. Rec. 79, 88-103.

Roberston, I.S.; Wilson, J.C. and Fraser, H.M. (1979): Immunological castration in male cattle. Vet. Rec. 105, 556-557.

Roberston, I.; Wilson, J.; Rowland, A. and Fraser, H.M. (1981): Further studies on the immunological castration in male cattle . Vet. Rec. 108, 381-382.

Semprini, P. (1964): The desexing of calves for meat production. Anim. Breed. Abstr. 33, Abstr. No. 3219.

Shokry, M. ; El-Keiey, M.; Hamdy, M.; Hassanein, A. and Moussa, M.H.G. (1984): Effect of partial castration on growth and carcase characteristics of native lambs. J. Egypt. Vet. Med. Ass. 44, No. 3 (137-151).

Snedecor, G.W. and Cochran, W.G. (1967): Statitical methods 6th ed. Iowa State University, Iowa, Press.

Veeramachaneni, D.N.R.; Ott, R.S.; Heath, E.H. McEntee, K.; Bolt, D.J. and Hixon, J.E. (1986): Pathophysiology of small testes in beef bulls: Relationship between scrotal circumference, histopathologic features of testes and epididymides, seminal characteristics, and endocrine profiles. Am. J. Vet. Res., 47, No. 9. 1988-1999.

Venugopalan, A. (1982): Essentials of Veterinary Surgery. 4th. ed. Oxford and IBH publishing Co., New Delhi.

Turner, A.S. and Mcilwraith, C.W. (1982): Techniques in large animal surgery. 1st ed. Lea & Febiger, Philadelphia.

Wawrzynczak, S. (1965): The effect of partial castration on the fattening of young bull. Anim. Breed. Abstr., 34, 94.

Weaver, A. (1986): Bovine surgery and lameness. 1st ed., Blackwell Scientific Publications. USA.

LEGENDS

Fig. 1: Showing the testes and scrotum directly after their ablation (subgroup 11-B).

Fig. 2: Showing the discolouration of the distal half of the scrotum with a sharp border at the site of cruching.

Fig. 3: Histogram showing the mean testicular volume before and after bloodless castration in native bulls.

Fig. 4: Showing the scrotum 3 days after standard-open castration. Notice the opened scrotal wound.

Fig. 5: Showing suture line after complete ablation of the testes and scrotal sac (subgroup II-B).

Fig. 6: Showing healing by first intention after castration by complete ablation of the testes and scrotal sac.

Fig. 7: Sagital section of the testis 3 days PC showing the dark red discolouration of the testis and clotted blood in the testicular blood vessels (arrow indicating the area of cruching).

Fig. 8: Histological section in a testis 7 days PC showing congestion, edema in the intertubular spaces and necrosis of most of the spermatogenic cells. H&E (X100).

Fig. 9: Histological section in a testis 14 days PC showing complete necrosis of the seminiferous tubules that exhibited irregular outlines and shrinkage leaving hallow spaces. H&E (X100).

Fig. 10: Sagital section of the testis on day 21 PC showing yellowish brown discolouration of the testis and clotted blood in the blood vessels of the spermatic cord and the deeper part of the tunica albuginea.

Fig. 11: Histological section in the epididymis 21 PC showing degeneration with vacuolation and sloughing of the epithelium. H&E (X250).

Fig. 12: left: Sagital section of the testis on day 28 PC showing pale colouration and of the testicular tissue and thickening of the tunica albuginea. Notice the disappearence of the colour of the clotted blood in the testicular blood vessels due to its organization (arrow).
Right: Sagital section of the testis on 70 days pc, showing marked fibrosis of the testicular tissue and spermatic cord with pale yellow discolouration.

Fig. 13: Histological section in a testis 70 days PC showing massive fibrosis and granulation tissue around the necrosed tubules. Notice the newly formed blood vessel. H&E (X250).

Fig. 14: Showing marked atrophy of the accessory genital glands of bloodless castrated animal 50 days PC: A-Ampullae B-Bulbourethral glands S-Seminal glands. P-Prostate (body).

Fig. 15: Histological section in the ampulla 28 days PC showing marked connective tissue proliferation under the tunica muscularis with extension around the glandular acini. H&E (X100).

Fig. 16: Histological section in the seminal glands 95 days PC showing atrophy and reduction of the glandular tissue due to massive fibrosis. H&E (X100).

Table (1): Mean (±S.E) testicular volume (cm) before and after castration by bloodless method in native bulls.

Testis	Before castration	Days after castration				
		3	15	30	45	60
Right (n)	80.35± 15.00 (6)	91.62± 13.04 (6)	63.58± 4.46 (5)	53.47± 5.03 (5)	28.34± 6.08 (4)	19.79± 3.59 (4)
Left (n)	60.93± 6.27 (6)	85.23± 9.21 (6)	57.27± 4.39 (5)	43.55± 4.31 (5)	22.36± 4.26 (4)	16.83± 2.55 (4)

n:Number of the animals.

Table (2): Mean (±S.E) serum levels of testosterone (ng/ml) before and after castration by the bloodless method.

Bull NO.	Before castration	Days after castration			
		7	14	21	30
1-	0.550	Off curve	Off curve	Off curve	Off curve
2-	0.427	Off curve	Off curve	Off curve	Off curve
3-	0.681	Off curve	Off curve	Off curve	Off curve
4-	0.108	Off curve	Off curve	Off curve	Off curve
5-	5.143	Off curve	Off curve	Off curve	Off curve
6-	5.855	Off curve	Off curve	Off curve	Off curve
(Mean±S.E)	2.12±1.07	Off curve	Off curve	Off curve	Off curve

Table(3): Mean (±S.E) serum levels of testosterone (ng/ml) before and after castration by the open technique.

Bull NO.	Before castration	Days after castrtion			
		7	14	21	30
1-	0.240	Off curve	Off curve	Off curve	Off curve
2-	1.044	Off curve	Off curve	Off curve	Off curve
3-	2.065	Off curve	Off curve	Off curve	Off curve
4-	2.136	Off curve	Off curve	Off curve	Off curve
(Mean±S.E)	1.37±0.45	Off curve	Off curve	Off curve	Off curve

Table (4): Mean (±S.E) weights (gm) of accessory genital glands of native bulls before and 2 months after castration by bloodless method.

Time	Seminal glands	Body of prostate	Bulbourethral glands	Ampullae ductus deferens
Before castration (n)	** 27.88±2.09 (6)	3.48±1.15 (3)	** 7.025±0.44 (6)	7.10±0.13 (6)
After castration (n)	18.87±0.77 (6)	2.20±0.07 (3)	5.76±0.39 (6)	6.74±0.31 (6)

**: Highly significant difference at ($p < 0.01$).
n: Number of glands.

Table (5): Mean (±S.E) weights (gm) of accessory genital glands of native bulls before and 2 months after castration by open technique.

Time	Seminal glands	Body of prostate	Bulbourethral glands	Ampullae ductus deferens
Before castration (n)	** 27.88±2.09 (6)	3.48±1.15 (3)	** 7.025±0.44 (6)	7.10±0.13 (6)
After castration (n)	15.57±1.7 (6)	2.33±0.26 (3)	5.30±0.59 (6)	6.42±0.35 (6)

**: Highly significant difference at ($p < 0.01$).
n: Number of glands.


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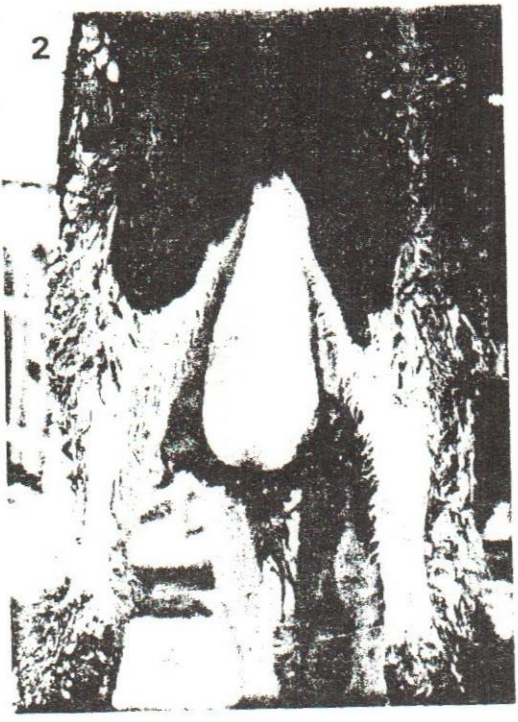
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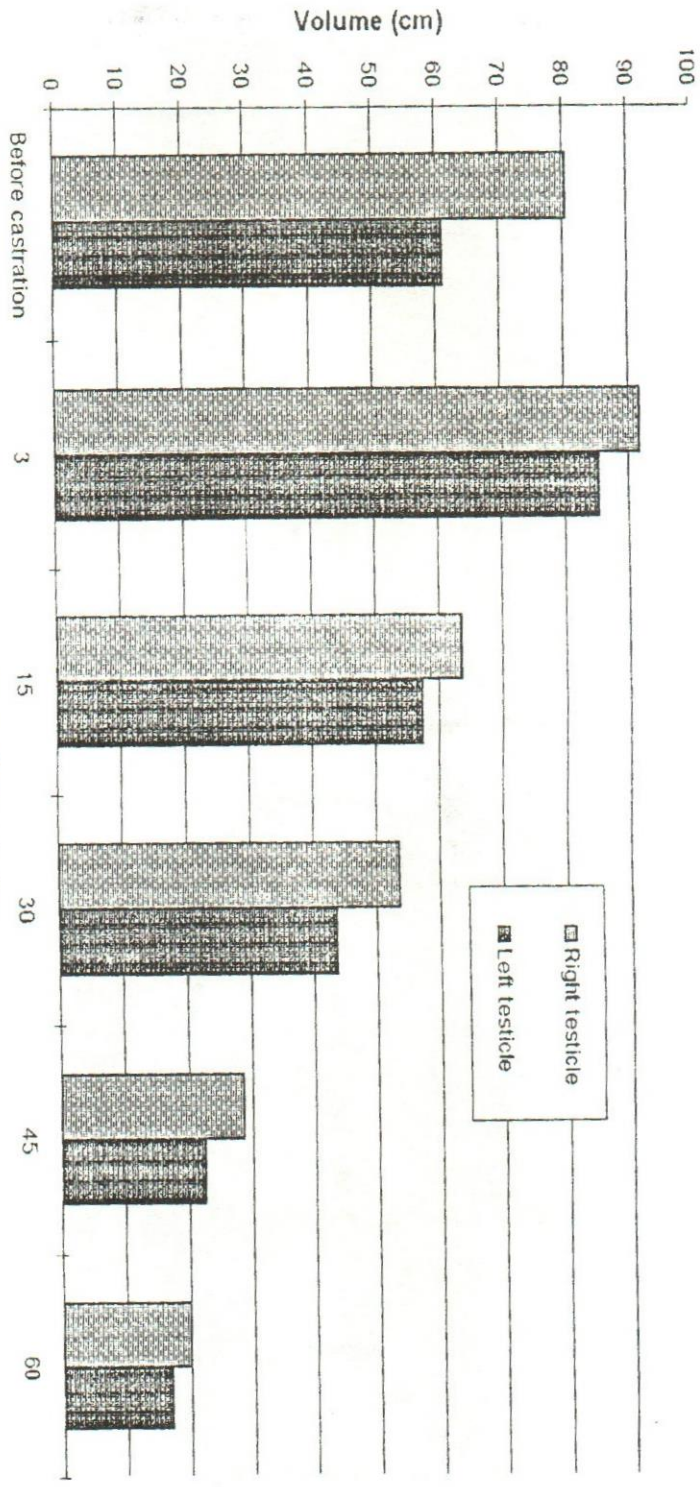
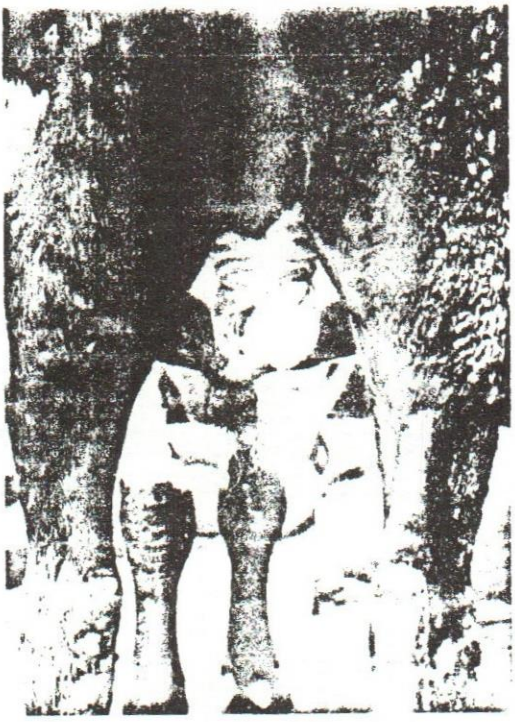
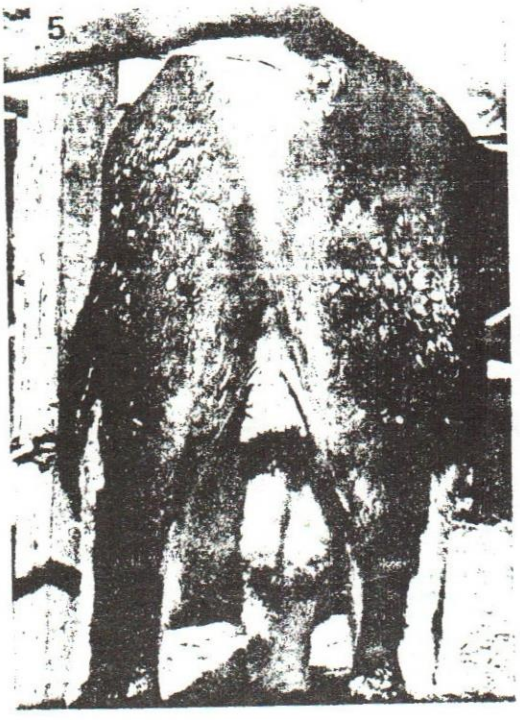
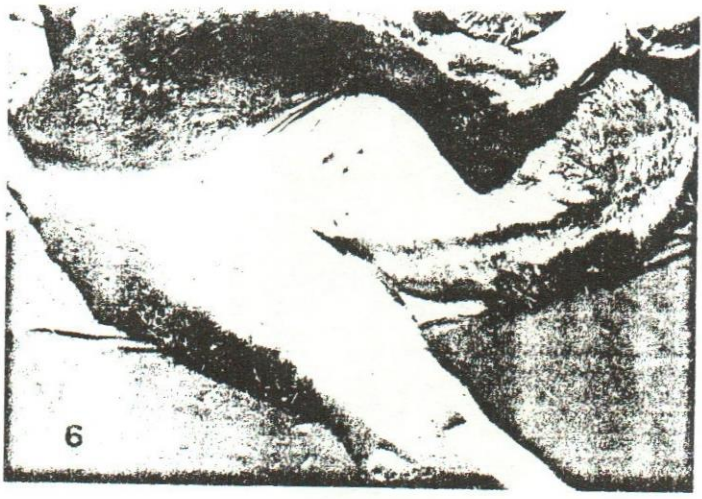


Figure (3) showing the mean testicular volume before and after bloodless castration in native bulls



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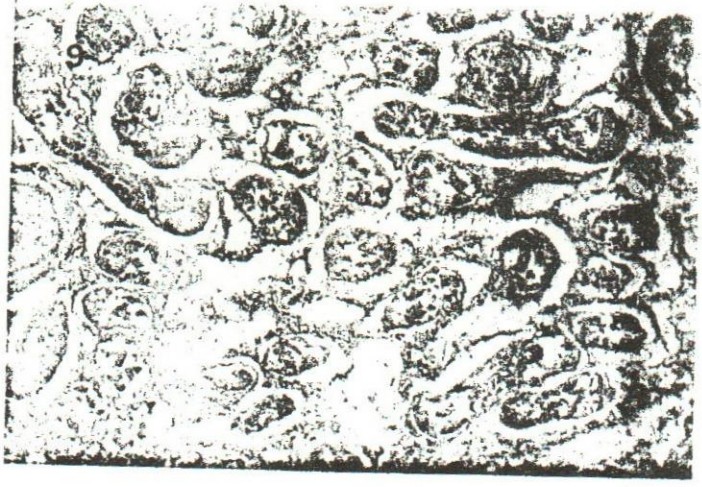
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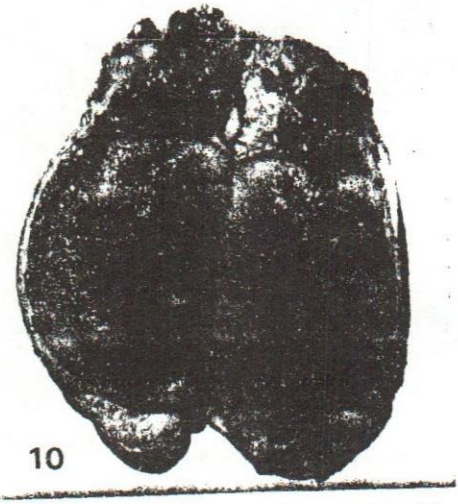

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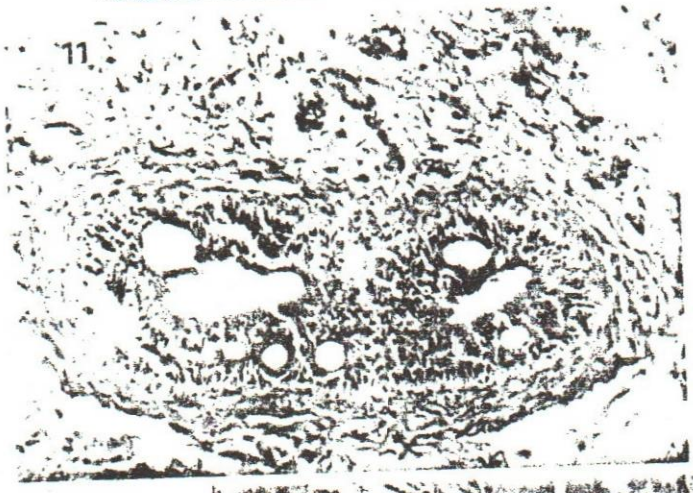

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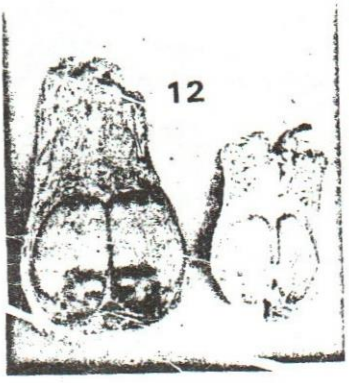

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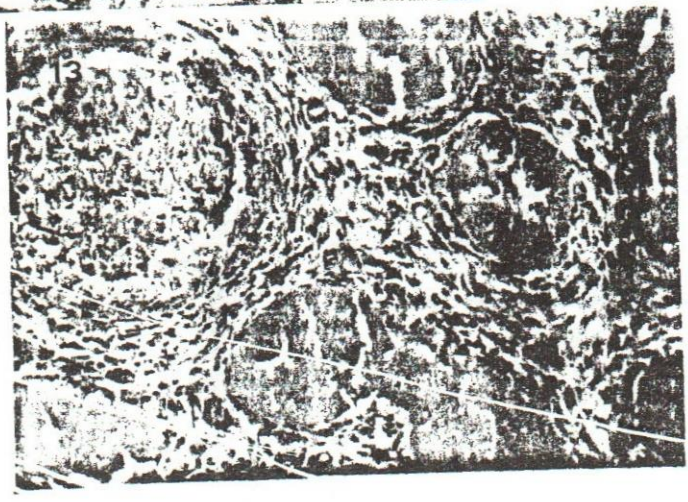

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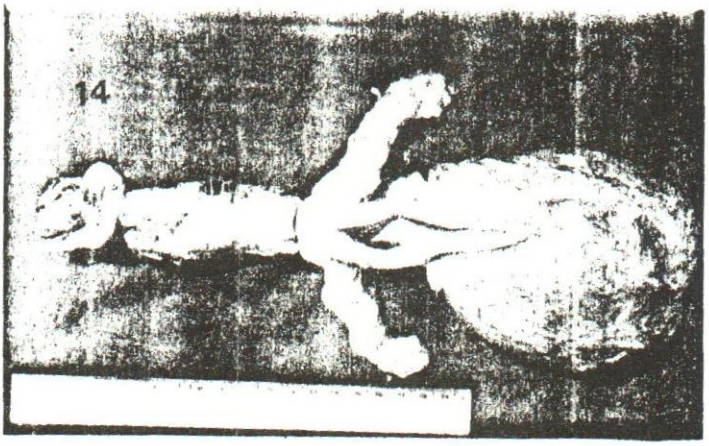
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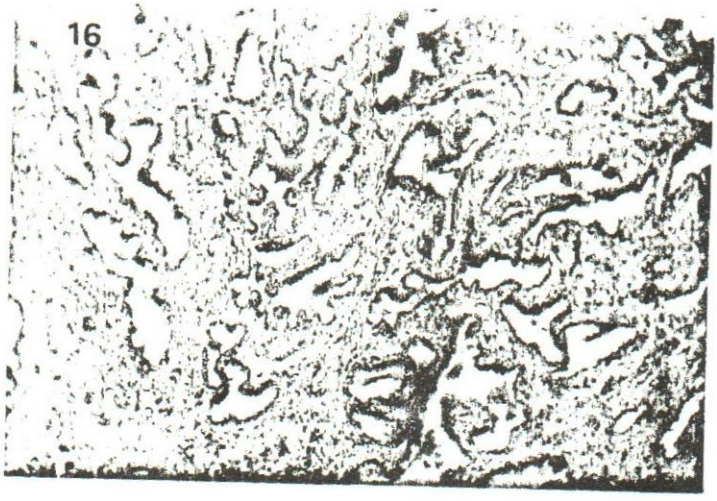
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