



Feasibility of pre-scrotal castration approach in boars: 30 cases¹

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ABSTRACT. Câmara A.C.L., Nogueira K., Junqueira J.V.S., Andrade T.S., Teixeira-Neto A.R. & Campebell R.C. 2023. **Feasibility of pre-scrotal castration approach in boars: 30 cases.** *Pesquisa Veterinária Brasileira* 43:e07278, 2023. Hospital Escola de Grandes Animais, Universidade de Brasília, Área Especial SRB, Galpão 4, Granja do Torto, DF 70636-200, Brazil. E-mail: aclcamara@yahoo.com.br

Since the first reports of boar castration, the anesthesia, surgery, and especially the restraint for surgical wound management of large and strong boars may be challenging. Most frequent complications include hemorrhage, excessive edema, infection, abscess, scirrhus cord, inguinal hernia, seroma, hematoma, and death. In order to diminish those complications, we hypothesized that the pre-scrotal approach would be a successful method for orchiectomy in boars and that the complication rate would be low, facilitating post-surgical handling on the commercial swine breeding farms by the owners or handlers. Therefore, the present study aimed to describe our experience performing castration in boars using a pre-scrotal approach on farm-setting. Thirty commercial-breed male boars (weighing 255-410kg) were submitted to dissociative anesthesia protocol and local anesthesia. An 8-10cm skin incision was made cranially to the hemiscrotum, and subcutaneous tissue was bluntly dissected, reaching the *tunica dartos*, fascia, and vaginal tunica. Mesorchium was bluntly dissected to separate, and a double size-0 transfixion ligature was placed around the spermatic cord that was sharply transected. The procedure was repeated on the contralateral testis using the same skin incision. Short-term complication was restricted to mild scrotal edema in 12 (40%) boars. No wound exudate, surgical site infection or death related to the surgery was recorded. On the long-term follow-up (≥ 4 months' post-surgery), all owners stated that the boar was subsequently used as intended (slaughter after the proper boar taint withdrawal time) and their satisfaction with the low degree of difficulty in handling the post-operative care. Herein, the overall complication rate was considered low, the mortality rate was zero, and the pre-scrotal castration approach was successfully performed in all boars. These features confirm the technique as a safe procedure for orchiectomy in boars. Additionally, abolishing the daily dressing of surgical wounds required in open castration techniques, especially when surgical site infection occurs, may provide better welfare for the boars.

INDEX TERMS: Castration, culled boars, orchiectomy, pre-scrotal approach, swine, welfare.

RESUMO.- [Viabilidade da castração de cachaços por abordagem pré-escrotal: 30 casos.] Desde os primeiros

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relatos de castração de cachaços, a anestesia, a cirurgia, e, principalmente, a contenção para manejo de feridas cirúrgicas de cachaços grandes e fortes podem ser desafiadoras. As complicações mais frequentes incluem hemorragia, edema excessivo, infecção, abscesso, funiculite, hérnia inguinal, seroma, hematoma e morte. A fim de diminuir tais complicações, levantamos a hipótese de que a abordagem pré-escrotal seria um método bem-sucedido para orquiectomia em cachaços e que a taxa de complicações seria baixa, facilitando o manejo pós-cirúrgico pelos proprietários ou tratadores. Portanto,

o presente estudo objetivou descrever nossa experiência na castração de cachacos por abordagem pré-escrotal nas granjas comerciais de suínos. Trinta cachacos machos de raças comerciais (variação de peso de 255-410kg) foram submetidos ao protocolo de anestesia dissociativa e anestesia local. Uma incisão cutânea de 8 a 10cm foi feita cranialmente ao hemiscroto, e o tecido subcutâneo divulsionado de forma romba atingindo a túnica *dartos*, fáscia e túnica vaginal. O mesórcio foi separado por divulsão, e, uma ligadura de transfixação dupla com fio 0 realizada ao redor do cordão espermático, que foi seccionado. O procedimento foi repetido no testículo contralateral usando a mesma incisão na pele. A complicação de curto prazo foi restrita a leve edema escrotal em 12 (40%) cachacos. Nenhuma infecção incisional, exsudato ou morte relacionada à cirurgia foi registrada. No acompanhamento a longo prazo (≥ 4 meses pós-cirúrgico), todos os proprietários afirmaram que o cachaco foi posteriormente utilizado como pretendido (abate após o tempo adequado de retirada do odor de macho inteiro), e sua satisfação com o baixo grau de dificuldade nos cuidados pós-operatórios. Aqui, a taxa geral de complicações foi considerada baixa, a taxa de mortalidade foi zero e a castração por abordagem pré-escrotal foi realizada com sucesso em todos os cachacos. Essas características confirmam a técnica como um procedimento seguro para orquiectomia em cachacos. Além disso, a abolição do curativo diário das feridas cirúrgicas exigido nas técnicas de castração aberta, principalmente quando ocorre infecção, pode proporcionar melhor bem-estar aos cachacos.

TERMOS DE INDEXAÇÃO: Abordagem pré-escrotal, bem-estar, cachacos de descarte, castração, orquiectomia, suínos.

INTRODUCTION

More recently, surgical castration of male piglets has become a welfare concern due to the pain and stress associated with performing the procedure without anesthesia (Squires et al. 2020). Surgical castration in piglets and immunocastration in adult male pigs is used as methods for preventing boar taint, which is caused by the accumulation of high levels of 16-androstene steroids (primarily androstenone) produced by Leydig cells in the testis and skatole and other indoles, which are produced from the metabolism of tryptophan by the gut microflora (Huber et al. 2018, Muniz et al. 2021).

In this context, culled boars present high levels of androstenone and skatole, diminishing the consumer acceptance of pork products made with its meat. Surgical castration of boars may be an option to increase the acceptance of this meat by consumers and also can benefit the welfare, reducing male sexual behavior and aggressiveness (Prado et al. 2018), especially during transport to the slaughterhouse (Hook et al. 2010). Additionally, in Brazil, the castration of pigs is mandatory at least 45 days before the animals are slaughtered, according to Decree-Law No. 135/2003 (Diário da República 2003).

We hypothesized that the pre-scrotal approach would be a successful method for orchietomy in boars and that the complication rate would be low, facilitating post-surgical handling on the commercial swine breeding farms by the owners or handlers. Therefore, the present study aimed to describe our experience performing castration in boars using a pre-scrotal approach on farm-setting.

MATERIALS AND METHODS

Ethical aspects. This study was approved by the Ethics Committee on the Use of Animals (CEUA) of the “Faculdade de Agronomia e Medicina Veterinária” (FAV) of the “Universidade de Brasília” (UnB, Brasília, Brazil), under process No. 14/2020.

Animals. Medical records from boars weighing over 250kg, submitted to castration by the pre-scrotal approach, were selected. Thirty male boars (weighing 255-410kg) from commercial swine breeding farms were included, and culling reasons involved aggressiveness, old age and poor reproductive performance. All boars were considered clinically healthy based on background information and physical examination. The boars were considered fit for a pre-scrotal castration approach if the testis and scrotum were macroscopically normal (no skin lesion or asymmetry) and the testis had mobility within the scrotum (no perceptible adhesions).

Anesthesia. The boars were fasted for 12h, and water was withheld 4h before surgery. For dissociative anesthesia protocol, a tiletamine and zolazepam combination (Zoletil® 100, Virbac, Hamburguesa/SP, Brazil) associated with xylazine (Equisedan®, JA Saúde Animal, Patrocínio Paulista/SP, Brazil) and ketamine (Cetamin®, Syntec, São Paulo/SP, Brazil) was administered intramuscularly. The mixture was obtained by reconstituting Zoletil® 100 (powder) in 2.5mL 10% ketamine and 2.5mL 10% xylazine, totaling 5mL solution (Henrikson et al. 1995), and the dosage of 0.03mL.kg⁻¹ was used. Local anesthesia was obtained by intratesticular and pre-scrotal infiltrative lidocaine 2% injection (4mg.kg⁻¹) (Fig.1-4).

Surgical approach. Surgical procedures were performed on a clean stall (3x4m) on each swine breeding farm. The boars were placed on left or right lateral recumbency with both forelimbs tied together and stretched with a rope. Each hind limb was tied separately, causing abduction (Fig.1 and 2). Antimicrobials (long-acting oxytetracycline: 20mg.kg⁻¹) and non-steroidal anti-inflammatory drugs (flunixin meglumine: 2.2mg.kg⁻¹) were administered preoperatively in all boars. The caudal ventral abdomen was clipped, and the scrotum and perineum were aseptically prepared. Initially, the assistant surgeon pushed both testicles forward to facilitate the selection of the pre-scrotal incision location (Fig.3 and 4). An 8-10cm skin incision was made cranially to the hemiscrotum (Fig.5). Subcutaneous tissue was bluntly dissected, reaching the tunica *dartos*, fascia, and vaginal tunica (Fig.6), which was then incised. The vaginal tunica was opened until the testicle could be exteriorized. A transfixion ligature technique was performed with size-0 absorbable multifilament suture (polyglactin 910) on the fibrous-muscle portion of the spermatic cord (Fig.7). Mesorchium was manually bluntly dissected to separate the spermatic cord from the surrounding fascia (Fig.8). A double transfixion ligature was placed around the spermatic cord with the same suture material (Fig.9). Then the spermatic cord was sharply transected with a 24-scalpel blade. The pedicle was released into the surgical incision after proper hemostasis was confirmed (Fig.10). The aforementioned procedure was repeated on the contralateral testis using the same initial skin incision. Afterward, both vaginal tunics were left open, and the subcutaneous tissue was closed using the same suture material in a simple continuous pattern. Skin closure was obtained by Wolf pattern using size 2-0 absorbable monofilament suture material (poliglecaprone 25) to avoid new anesthesia or physical restraint of the boar to suture removal. Then a repellent and antibiotic mixture (Bactrovet; König, Mairinque/SP, Brazil) was sprayed on the surgical site (Fig.11-14).

Post-operative care. If the boar did not recover from anesthesia in 3-hours, the owners were advised to change the recumbence side. Postoperatively, dipyrone pills (25mg.kg⁻¹; twice daily) were

mixed with the food during the next two days. The owners were also advised to maintain the boars on a clean and dry stall for seven days, to offer ration as soon as the boar could stand unassisted, and to spray the pre-scrotal incision with a repellent and antibiotic spray (Bactrovet; König, Mairinque/SP, Brazil) daily.

Follow-up information. Information regarding post-operative complications (e.g., prolonged recovery time, reduced feed intake, excessive swelling, surgical site infection or death) and whether the boar was subsequently used as intended (e.g., slaughter or sold) was determined by the follow-up (short and long-term) with the owner through a telephone call. Short-term follow-up was defined as 1-week, and long-term follow-up was defined as ≥ 4 months after surgery. The owners were also asked about the degree of difficulty in carrying out the post-operative care and their degree of satisfaction with the surgical procedure.

RESULTS

Thirty commercial-breed boars over 250kg were submitted for castration using the pre-scrotal approach. The intramuscular administration of injectable anesthetic agents promoting dissociative anesthesia allowed an uneventful surgical procedure on-farm setting. No complications were identified during

surgery, and both testicles were successfully exteriorized by the 8-10cm pre-scrotal incision in all boars.

Follow-up information was obtained 1-week (short-term) and 4-12 months (long-term) after surgery. On the short-term follow-up, the owners reported an agitated anesthetic recovery in the two heaviest boars that tried to stand, unsuccessfully, several times, causing a slight hemorrhage on the surgical site. The other 28 boars recovered well from dissociative anesthesia with no complications. Normal appetite and fecal output were reestablished within 4-hours after the boar could stand unassisted. Mild scrotal edema was reported in 12 (40%) boars that resolved within three days after the boar was released from stall confinement (after the 7th post-surgery day). On the long-term follow-up, all owners stated that the boars were subsequently used as intended (all were sent to slaughter after the proper boar taint withdrawal time). Additionally, all owners also reported a low degree of difficulty in handling the post-operative care and their satisfaction with the surgical procedure. During the short and long-term follow-up, no wound exudate, surgical site infection or death related to the surgery was recorded.



Fig.1-4. (1) A boar placed on left lateral recumbency with each hind limb tied separately, causing abduction. Local anesthesia by intratesticular infiltrative lidocaine 2% is being performed. (2) Another boar placed on the right lateral recumbency before surgery. (3, 4) The assistant surgeon pushed both testicles forward to facilitate the selection of the pre-scrotal incision location.

DISCUSSION AND CONCLUSION

Since the first reports of boar castration, the anesthesia, surgery, and especially the restraint for surgical wound management of large and strong boars may be challenging (Abell 1951). In adult boars, the most routine castration technique performed is the open orchietomy under sedation or general anesthesia. The larger size of the incisions on the scrotum is associated with a higher rate of post-operative complications, including herniation/evisceration, hemorrhage, excessive edema, seroma, hematoma, infection, abscess, scirrhus cord, inguinal hernia, and death (Anderson & St. Jean 2012, Ravagnani et al. 2014, Scollo et al. 2016, Callan et al. 2017, Salcedo-Jiménez et al. 2020, Skelton et al. 2021).

To minimize post-surgical complications, the use of a pre-scrotal approach for castration in large boars may be beneficial since the technique has been successfully performed on other species, such as dogs, cats (MacPhail 2013), llamas (Baird et al. 1996), pet rabbits (Duhamelle et al. 2018), and even mini and pot-bellied pigs (Østevik et al. 2012, Salcedo-Jiménez et al. 2020). Advantages of the pre-scrotal castration approach include low post-operative complications rate (MacPhail 2013), significantly shorter anesthesia time and scrotal edema in pet rabbits (Duhamelle et al. 2018), and less aftercare and

incisional pain in llamas (Baird et al. 1996). This seems to be the first study reporting the feasibility technique on adult and heavy boars from commercial swine breeding farms. Additionally, based on our results, the overall complication rate was considered low, and the pre-scrotal approach was successfully performed in all boars.

Few works provide data on orchietomy techniques and post-surgical complications in culling boars (Ravagnani et al. 2014). Although the overall use of boars in commercial swine farms has decreased dramatically, boars are still a dynamic sub-population of the swine production herd (Hook et al. 2010, Knecht et al. 2017). To minimize consumer disapproval, as frequently reported in piglets and growing pigs (Huber et al. 2018, Prado et al. 2018, Squires et al. 2020, Muniz et al. 2021), culled boars must also be castrated at least 45 days before slaughter (Diário da República 2003), so that their meat can be used in the food industry (Ravagnani et al. 2014, Callan et al. 2017).

In a previous study comparing suturing the scrotal skin after open surgical castration using an emasculator in boars, both groups presented complications, such as excessive swelling, surgical site infection, and purulent discharge, taking 30 to 45 days to complete healing (Ravagnani et al. 2014). Recently, a retrospective study with 106 pet pigs presented that 58.5% (62/106) of the cases submitted to pre-scrotal



Fig.5-10. (5) An 8-10cm skin incision cranial to the hemiscrotum. (6) Visualization of the vaginal tunica through the pre-scrotal incision. (7) The vaginal tunica was opened until the testicle could be exteriorized, and a size-0 transfexion ligature was placed on the fibrous-muscle portion of the spermatic cord (arrow). (8) Spermatic cord separated from the surrounding fascia. (9) Spermatic cord after a size-0 double transfexion ligature was placed (inset). (10) The pedicle was released into the surgical incision after proper hemostasis was confirmed.

incisions were closed in two layers with an intradermal suture pattern, in 0.94% (1/106) of cases, the skin was closed in a simple continuous pattern, and 22.6% (24/106) of cases the incisions were stretched manually and left open. Five pigs experienced post-operative complications (complication rate: 4.7%), consisting of mild peri-incisional swelling, and the techniques were considered safe procedures with minimal rate of complications (Salcedo-Jiménez et al. 2020). In our study, 40% (12/30) of the boars presented scrotal swelling, considered a minor post-operative complication, that resolved after the release from stall confinement. Considering that the pet pig's body weight ranged from 2.8 to 350kg (mean: 22.4kg \pm 44.9kg) (Salcedo-Jiménez et al. 2020), and that there were no records of how many boars over 250kg were castrated, the comparison with the results herein is impaired.

The double transfixion ligature with size-0 polyglactin 910 on the spermatic cords performed herein proved to be a safe hemostasis method even in the largest boars, as previously reported on pigs submitted to cryptorchidectomy (Skelton et al. 2021). Recently, using nylon clamps for hemostasis of the spermatic cords in 90-day-old pigs submitted to orchietomies reduced the total surgery time and hemorrhages compared

to hemostasis with nylon ligatures (Prado et al. 2018). The mortality rate in the present study was zero, confirming that the pre-scrotal technique is a safe approach for castration in heavy and large boars.

The limitations of the present study included its retrospective nature, which resulted in some missing data, precluding a coherent statistical analysis and reliance on owner recall for complications and outcome information. However, the overall complication rate was considered low, the mortality rate was zero, and the pre-scrotal castration approach was successfully performed in all boars. These features confirm the technique as a safe procedure for orchietomy in boars. Additionally, the abolishment of the daily dressing of surgical wounds required in open castration techniques, especially when surgical site infection occurs, may provide better welfare for the boars.

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Conflict of interest statement.- The authors declare no conflicts of interest.



Fig.11-14. (11, 12) Boars in left lateral recumbency immediately after surgery. Note the scrotum flaccidity. (13) Surgical wound appearance after skin closure using size 2-0 absorbable monofilament suture material in Wolf pattern. (14) Length of skin incision compared to a scalpel.

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