

# Eye enucleation and exenteration in cattle: a retrospective study of 38 cases (2013–2020)

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## Enukleation und Exenteration des Augapfels beim Rind: eine retrospektive Studie mit 38 Fällen (2013–2020)

Ziel der Studie war es, die klinischen Indikationen für die Enukleation und Exenteration des Augapfels, das Auftreten von Komplikationen und das Langzeitergebnis beim Rind zu beschreiben. Zusätzlich wurde die Einstellung der Besitzer zur Enukleation und Exenteration sowie ihre Zufriedenheit mit dem chirurgischen Ergebnis untersucht.

Die Krankenakten der beiden veterinärmedizinischen Lehrspitäler in der Schweiz wurden überprüft, um Rinder zu identifizieren, die zwischen Januar 2013 und Dezember 2020 einer einseitigen Enukleation oder Exenteration unterzogen wurden. Die extrahierten Daten umfassten Anamnese, Augenuntersuchung, klinische Diagnose, chirurgischer Eingriff einschliesslich Anästhesie, verwendetes Nahtmaterial und – technik, Komplikationen und deren Behandlung. Zur Bestimmung der Langzeitbehandlungsergebnisse wurde die Überlebenszeit der Tiere mittels Abfragen in der nationalen Tierdatenbanken bestimmt und Besitzerinterviews unter Verwendung eines standardisierten Fragebogens durchgeführt. Abgefragt wurde das Auftreten von Komplikationen, Gründe für das Keulen, Produktionsleistung, wahrgenommene Lebensqualität nach dem Eingriff, Bedenken, Entscheidungsfaktoren die Operation durchzuführen, und allgemeine Zufriedenheit mit dem Ergebnis. Die Daten wurden mittels deskriptiver Statistik zusammengefasst und mögliche Unterschiede zwischen den Variablen mittels Exaktem Fisher-Tests und ungepaarten t-Test analysiert. Das Signifikanzniveau wurde bei  $p < 0,05$  festgelegt.

Die Studie umfasste 38 Fälle mit einem Durchschnittsalter von 5 Jahren. Mehr als die Hälfte der Fälle (55,3%) wurden mit nicht-neoplastischen Augenläsionen diagnostiziert, die durch ein schweres Trauma mit Verlust des Bulbusinhaltes, Bulbusruptur mit Vorgeschichte einer infektiösen Keratokonjunktivitis, Hypopyon oder angeborene Fehlbildungen gekennzeichnet waren. Bei

## Summary

The study aimed to describe clinical indications for eye enucleation and exenteration, the occurrence of complications and long-term outcome in cattle, and examine owners' attitude towards enucleation and exenteration and their satisfaction with the surgical outcome.

Medical records from the two veterinary teaching hospitals in Switzerland were reviewed to identify cattle that underwent unilateral enucleation or exenteration between January 2013 and December 2020. Data extracted included medical history, ocular examination, clinical diagnosis, surgical procedure including anesthesia, suture material and pattern used, complications, and treatment thereof. Long-term follow-up was evaluated via national animal database inquiries to determine survival time and via owners' interviews with the use of a standardized questionnaire that included questions regarding the occurrence of complications and reason for culling, production performances and perceived quality of life after surgery, concerns, factors affecting the decision to proceed with surgery, and general satisfaction with the outcome. Descriptive statistics, Fisher's exact tests and unpaired *t*-test were used to summarize the data and assess association between variables. Association was considered significant if  $p < 0,05$ .

Thirty-eight cases were identified, with a median age of 5 years. More than half of the cases (55,3%) were diagnosed with non-neoplastic ocular lesions represented by severe trauma with loss of globe content, globe rupture with history of infectious keratoconjunctivitis or hypopyon, or congenital malformations. The remaining cases were diagnosed with neoplastic lesions, including ocular squamous cell carcinoma (OSCC), melanoma, or sarcoma. Complications following surgery were reported in 29% of cases and included postoperative infection and recurrence of OSCC. There was no significant association between ocular diagnosis and the occurrence of postoperative complications or survival time.

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den verbleibenden Fällen wurden neoplastische Läsionen diagnostiziert, darunter okulares Plattenepithelkarzinom (OSCC), Melanom oder Sarkom. Postoperative Komplikationen wurden in 29 % der Fälle berichtet und umfassten Infektionen und Rezidive von OSCC. Es gab keine signifikanten Zusammenhänge zwischen der Diagnose und dem Auftreten postoperativer Komplikationen oder der Überlebenszeit.

Die Operation schien die postoperative Produktionsleistung der Tiere oder die wahrgenommene Lebensqualität nicht zu beeinflussen. Die meisten Besitzer (92 %) waren mit dem Ergebnis zufrieden. Das Auftreten von postoperativen Komplikationen, die zu erhöhten Gesamtkosten und Keulungen führten, war der Hauptgrund für die geringere Zufriedenheit der Tierhalter.

**Schlüsselwörter:** Rinder, Augenchirurgie, Enukektion, Exenteration, Augenhöhle, Plattenepithelkarzinom

Surgery did not seem to influence the animals' postoperative production performance or the perceived quality of life. Most owners (92 %) were satisfied with the surgical outcome. The occurrence of postoperative complications leading to increased overall costs and culling was the main reason for lower owner satisfaction.

**Keywords:** cattle, ocular surgery, enucleation, exenteration, orbit, squamous cell carcinoma

## Introduction

Eye enucleation, defined as surgical removal of globe, conjunctiva, and nictitating membrane, and exenteration, defined as removal of the entire orbital content, are commonly performed in cattle.<sup>7,10</sup> Both surgical procedures may be performed under general anesthesia or with a combination of sedation and locoregional anesthesia. In the second case, risks and costs associated with general anesthesia are avoided.

Transpalpebral and transconjunctival surgical approaches have been described, and the first is preferred if infection or neoplasia is present to prevent orbital contamination. Enucleation and exenteration are indicated for the treatment of painful ocular diseases such as trauma to the eye with loss of globe content, septic panophthalmitis and phthisis bulbi, and infectious keratoconjunctivitis with secondary globe perforation, and to prevent progression of ocular neoplasia, for example, ocular squamous cell carcinoma (OSCC) and retrobulbar lymphosarcoma.<sup>11</sup> Previous retrospective studies identified OSCC as the most frequent indication for enucleation or exenteration.<sup>1,6</sup>

Common complications following these surgical procedures include surgical site infection (SSI), suture dehiscence, and progression/recurrence of neoplasia.<sup>3,5,9</sup> Neurologic signs due to optic nerve stretching, although rare, have also been reported.<sup>6</sup>

There are multiple factors affecting veterinarians' and owners' decisions to proceed with enucleation or exenteration in ruminants. They include the type and stage

of the ocular lesion, costs of surgery, possibility to comply with postoperative management, and economic, genetic, and emotional value of the animal. Although ruminants diagnosed with painful and medically intractable eye diseases are assumed to have an improved quality of life following enucleation/exenteration, owners may be reluctant to consider these surgical procedures due to misgivings regarding productivity, quality of life, discomfort, and cosmetic appearance. Although studies have been conducted assessing postoperative complications and animal longevity within the herd, there is limited information on the owner's attitude and satisfaction towards these procedures.

In our clinical impression, non-neoplastic ocular diseases represent a more common indication for enucleation/exenteration than previously reported and appear to be associated with a lower postoperative complication rate. Therefore, the objective of this study was to describe the clinical indications, related complications, and long-term outcomes following enucleation/exenteration in the caseload of the two veterinary medical teaching hospitals in Switzerland between 2013 and 2020. Furthermore, this retrospective study aimed to determine owners' attitudes and satisfaction towards enucleation/exenteration.

## Materials and Methods

### Animals

Medical records of cattle presented to the Clinic for Ruminants, Vetsuisse Faculty, University of Bern and the Clinic for Ruminants, Vetsuisse Faculty, University

of Zurich, that underwent unilateral enucleation or exenteration between January 1<sup>st</sup>, 2013 and December 31<sup>st</sup>, 2020 were reviewed. Retrieved data included patient signalment, eye examination findings, clinical diagnosis, surgical procedure, anesthesia protocol, suture material and pattern used, complications, and outcome. Diagnosis of ocular trauma with globe content loss (Figure 1) or infectious keratoconjunctivitis with secondary globe rupture was based on history and ocular examination. Diagnosis of OSCC (Figure 2) or other neoplastic conditions was based on the clinical appearance of the lesion and/or histopathology.

Long-term follow-up was conducted through owners' telephone interviews with the help of a standardized questionnaire, which included questions regarding the occurrence of postoperative complications and reason for culling, production performances and perceived quality of life after surgery, concerns and factors affecting the decision to proceed with surgery, and general satisfaction with the outcome. Owners' satisfaction was graded on a 0–5 scale, with 0 being completely unsatisfied and 5 being completely satisfied. In case of post-operative complications, diagnosis of SSI was based on the Centers for Disease Control and Prevention criteria and neoplasia recurrence on clinical examination. According to the treating veterinarian, SSI was managed by suture removal and drainage of the surgical site, with or without antibiotics and NSAIDs. Survival time after surgery was determined by inquiries of the Swiss Animal Trafficking Database (Agate).

### Statistics

Descriptive statistics were used to summarize the data. Association between the occurrence of postoperative complications and ocular diagnosis (non-neoplastic versus neoplastic disease) or surgical technique (exenteration versus enucleation), as well as the association between the occurrence of postoperative SSI and variables such as ocular diagnosis, ophthalmic artery ligation, subcutaneous tissue suturing, suture pattern, and suture material (absorbable versus non-absorbable) used for skin closure, were assessed with Fisher's exact tests. Association between ocular diagnosis and survival time was evaluated with an unpaired *t*-test. Association was considered significant if  $p < 0,05$ .

### Results

Thirty-eight cattle were included in this retrospective analysis. Breeds are summarized in Table 1. All were females except one breeding bull. Among the enrolled cattle, 19 were pregnant multiparous cows, nine were non-pregnant cows, two were pregnant heifers, four were non-pregnant heifers, and three were nursing calves. The



**Figure 1:** Photographic representation of the right eye region of a three-year-old Holstein cow presented for severe ocular trauma with loss of globe content; note iris prolapse through corneal laceration.



**Figure 2:** Photographic representation of the right eye region of a seven-year-old Montbéliarde cow diagnosed with OSCC.



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median age at presentation was 5 years (range: 20 days–16,3 years). Indications for enucleation or exenteration were non-neoplastic ocular diseases in 21 cases (55,3 %) and neoplastic lesions in 17 cases (44,7 %). Non-neoplastic ocular diseases included 17 cases of severe ocular trauma with loss of globe content, globe perforation with a history of infectious keratoconjunctivitis in two cases and of hypopyon in one case, and one congenital eye malformation. Diagnosed neoplastic ocular diseases included 14 OSCC, two melanoma, and one sarcoma. OSCC occurred in five Fleckvieh, four Montbéliarde, three Simmental and two Holstein cattle. Diseased right and left eyes were similarly represented (n=18 and n=20 respectively). Twenty-five animals underwent exenteration and 13 enucleations. A transpalpebral approach was used in 31 cases, while the transconjunctival approach was chosen in five cases of enucleation; the approach was not specified in two medical records.

The surgery was performed under general anesthesia in most of the cases (n=35, 97%), and in n=31 (89%) of them in association with regional anesthesia; standing sedation combined with regional anesthesia was used in only one case, while the anesthetic technique was not reported in two cases. When performed, regional anesthesia was achieved through a Peterson block (n=14) or a 4-point retrobulbar block (n=16) combined with the auriculopalpebral block (n=12) and/or local infiltration of the eyelids (n=8).<sup>4</sup> Anesthesia-related complications occurred in 12 cases (33%) and included regurgitation of ruminal content (6/12), inadequate anesthesia or sedation (5/12), severe bradycardia with HR <30 bpm (4/12), radial nerve paresis (4/12), and mild signs of pulmonary edema during the recovery period (1/12).

In all cases, intraoperative hemostasis was achieved using a Stelle vessel pattern clamp over the optic pedicle and gauze packing of the orbit. Additional hemostasis was performed in 9 cases (24%) by ligating the ophthalmic artery using mono – or multifilament absorbable suture material. Closure of the surgical site included

subcutaneous tissue suturing in 33 cases (86,8%), with a simple continuous or Cushing pattern using mono – or multifilament absorbable suture material. Closure of the skin incision was accomplished using a Reverdin (Ford) interlocking pattern in 23 cases (64%), horizontal mattress sutures in four (11,1%), simple interrupted sutures in four (11,1%), skin staples in three (8,3%), and cruciate sutures in two cases (5,5%); the suture pattern was not specified in two medical records. Suture material used for skin closure was polydioxanone (PDS II) in 18 cases (54%), polyamide (Supramid) in 13 (39%), polypropylene (Prolene) in one (3%), and polybutester (Novafil) in one case (3%). Intraoperative complications were reported in 14 cases (37%) and included moderate hemorrhage in 13 cases and damage to the orbital bone during debridement in two cases, one diagnosed with OSCC and one with severe ocular trauma. None of the hemorrhages required blood transfusion.

Perioperative systemic antibiotics and NSAIDs were administered in 37 cases for  $6 \pm 2$  days and  $5 \pm 2$  days (mean  $\pm$  SD), respectively. The information could not be retrieved from one medical record. The choice of the molecule used was based on eye disease, clinician's preferences, age of the animal, and known allergies to specific products. Systemic antibiotics included penicillins, tetracyclines, fluoroquinolones, amoxicillin, and cephalosporins, while NSAIDs included flunixin meglumine, ketoprofen, and meloxicam. Hospitalization time following surgery was  $8 \pm 6$  days (mean  $\pm$  SD).

In 11 cases (29%), postoperative complications were reported, including nine SSI and three OSCC recurrence cases. The latter occurred after one month in two cases and 48 months in the third case. Of the cases that experienced SSI, 5 had a diagnosis of non-neoplastic ocular disease, while 4 had an OSCC diagnosis. There was no significant association between ocular diagnosis and the occurrence of postoperative complications ( $p = 0,482$ ). Likewise, there was no association between ocular diagnosis ( $p = 1,000$ ), ophthalmic artery ligation ( $p = 0,339$ ) or subcutaneous tissue suture ( $p = 0,557$ ) and the occurrence of SSI. Skin suture pattern was not associated with the occurrence of SSI ( $p = 0,216$ ), nor was the suture material used ( $p = 0,447$ ). The frequency of complications was not statistically different when comparing enucleation and exenteration ( $p = 0,276$ ).

Long-term follow-up through telephone interviews with owners was obtained 1 to 8,5 years following hospital discharge for 33 of the 38 cases. Consultation of the national animal database revealed a median survival time after surgery of 1,6 years (range: 50 days–5,7 years). Seven animals were still alive when the inquiry was made (median 2,3 years; range 1,1–5,2 years) and included one animal diagnosed with OSCC (5,2 years) and six

**Table 1:** Breed distribution of cattle that underwent unilateral eye enucleation or exenteration between January 1<sup>st</sup>, 2013 and December 31<sup>st</sup>, 2020.

Breed	Number of cases	% of total
Brown Swiss	7	18,4
Eringer	2	5,3
Fleckvieh	7	18,4
Holstein	6	15,8
Jersey	1	2,6
Montbéliarde	4	10,5
Red Holstein	3	7,9
Simmental	6	15,8
Mixed	2	5,3

with non-neoplastic ocular diseases. Due to postsurgical complications, three cases were culled: OSCC recurrence in two and OSCC recurrence associated with severe orbit infection in one. There was no significant association ( $p = 0,972$ ) between ocular diagnosis and survival time. Owners' decision for surgery was commonly dictated by the overall value of the animal (73,5%) or their advanced pregnancy status (23,5%). Three owners considered the quality of life of their animal to be diminished after surgery because of postsurgical complications, while 30 rated the quality of life similar to that before surgery. Two owners mentioned that their animal had fallen in the herd hierarchy after surgery, though they did not consider it a diminished quality of life. Of the 27 dairy cattle, six owners noticed a temporary drop in milk production after surgery, one reported a lifelong decline in production, while 11 stated that milk production remained the same as before surgery; nine owners did not recall. One owner reported his animal having an infectious ocular disease affecting the contralateral eye, which was successfully managed medically by the herd veterinarian. Most owners (92%) were pleased with the surgical outcome giving a satisfaction score of 5 and would make the same choice again. Three owners wished they had elected to slaughter their animals, as they sustained complications that made it not economically beneficial overall.

## Discussion

Non-neoplastic ocular diseases seem to represent a more common clinical indication for eye enucleation or exenteration in cattle in Switzerland compared to earlier reports. Previous retrospective studies performed in the United States reported more than 80% of cattle that underwent enucleation or exenteration were diagnosed with OSSC.<sup>3,9</sup> Instead, more than half of the cattle population (55,3%) of the present study was diagnosed with non-neoplastic ocular lesions, represented mainly by severe trauma with loss of globe content. A possible explanation for this difference could be the absence of Hereford cattle, known as being predisposed to OSCC development,<sup>1</sup> in our study population compared to the above-mentioned reports. Lack of lid and corneoscleral pigment in Hereford cattle is heritable and genetically correlated and determines the degree of susceptibility to carcinogenic agents such as ultraviolet (UV) light.<sup>1</sup> Although our study population did not comprise Herefords, most cattle breeds represented in the current study, including Fleckvieh, Simmental, Montbéliarde and Holstein, are characterized by facial hypopigmentation and/or having pink skin around the eyes and are known to be susceptible to OSCC development.<sup>8,10</sup> Switzerland experiences high levels of UV solar irradiation during the

summer months when cattle graze daylong on high-altitude grassland in mountainous regions. The prevalence of OSCC lesions has been shown to increase significantly with an increase in mean annual hours of sunlight and altitude.<sup>2</sup> Risk factors for OSCC development seem, therefore, comparable to those experienced in the United States.<sup>3,9</sup> It must also be considered that it is possible that a part of the cattle affected by OSCC is culled without hospital referral thus decreasing the perceived prevalence of the disease. On the other hand, the higher rate of traumatic ocular diseases found in this study may be explained by the fact that more than 10% of the Swiss cattle population still wear horns, which increases risks for horn-induced injuries, including severe trauma with loss of globe content.

Perioperative complications were frequently encountered in the present study, and more than a third of the ruminants experienced anesthesia-related complications and/or moderate hemorrhage after severing the optic pedicle. Most ruminants in this study population underwent the surgical procedure under general anesthesia. Performing enucleation or exenteration under sedation and local anesthesia may significantly decrease the risks associated with general anesthesia, including regurgitation of ruminal content and occurrence of myopathies and neuropathies, as testified by other reports.<sup>3,9</sup> Despite the high proportion, none of the perioperative complications encountered in this study was considered life-threatening and none of the hemorrhages required blood transfusion.

The postoperative complication rate following enucleation or exenteration reported in the present study was higher than previously published rates.<sup>3,9</sup> Yet, when taken separately, the proportion of cases that experienced postoperative SSI was comparable to what was previously reported by Schulz et al.<sup>9</sup> On the contrary, the frequency of neoplasia recurrence among cases diagnosed with OSCC was 4 times higher than previously described.<sup>3,9</sup> However, long-term follow-up was obtained for nearly 90% of cases in this study, likely avoiding underestimation of the frequency of complications that may have occurred in previous studies with follow-up response rates between 27 and 41% only.

The present study results suggest that removal of one eye has little or no impact on cattle's production performances or perceived quality of life, with 92% of owners satisfied with the postoperative outcome. The occurrence of postoperative complications resulting in increased overall costs was the main reason for decreased owner satisfaction. The risk of postoperative complications is likely to act as a factor in deciding whether to undertake surgery and should, therefore, be thoroughly discussed with owners early on.

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Limitations of our study included those inherent to its retrospective nature, particularly missing data in the medical records. In addition, even if cases from two different veterinary medical teaching hospitals were considered, selection bias, given that ruminants from the same geographical area where collected, may be present. Moreover, despite providing more information, the long duration of follow-up (up to 8,5 years for some cases) may have generated some degree of recall bias among owners.

Eye enucleation and exenteration remain valuable options for the treatment of ocular pathologies causing severe pain. While the complication rate is moderate, most ruminants will afterwards have a good quality of life with production performances similar to those before occurrence of the eye disorder.

### Énucléation et exentération de l'œil chez les bovins : une étude rétrospective de 38 cas (2013–2020).

La présente étude vise à décrire les indications cliniques de l'énucléation et de l'exentération de l'œil, la survenue de complications et le résultat à long terme chez les bovins et à examiner l'attitude des propriétaires vis-à-vis de l'énucléation et de l'exentération et leur satisfaction quant au résultat chirurgical.

Les dossiers médicaux des deux hôpitaux universitaires vétérinaires de Suisse ont été examinés pour identifier les bovins qui ont subi une énucléation ou une exentération unilatérale entre janvier 2013 et décembre 2020. Les données extraites comprenaient les antécédents médicaux, l'examen oculaire, le diagnostic clinique, la procédure chirurgicale y compris l'anesthésie, le matériel et le patron de suture utilisés, les complications et leur traitement. Le suivi à long terme a été évalué en utilisant la base de données nationale sur les animaux afin de déterminer la durée de survie, et par d'entretiens avec les propriétaires à l'aide d'un questionnaire standardisé qui comprenait des questions concernant l'apparition de complications et la raison de la réforme, les performances de production et la qualité de vie perçue après la chirurgie, les réserves, les facteurs affectant la décision de procéder à la chirurgie et la satisfaction générale du résultat. Les données ont été résumées à l'aide de statistiques descriptives et les différences éventuelles entre les variables ont été analysées à l'aide de tests exacts de Fisher et de tests *t* non appariés. L'association a été considérée comme significative si  $p < 0,05$ .

Trente-huit cas ont été identifiés, avec un âge médian de 5 ans. Plus de la moitié des cas (55,3 %) ont été diagnostiqués avec des lésions oculaires non néoplasiques causées par un traumatisme grave avec perte du contenu du globe, une rupture du globe avec des antécédents de kératoconjunctivite infectieuse ou d'hypopion ou des malformations congénitales. Les autres cas ont été diagnostiqués comme des lésions néoplasiques, notamment carcinome épider-

### Enucleazione ed esenterazione oculare nei bovini: studio retrospettivo di 38 casi (2013–2020)

Lo studio si proponeva di descrivere le indicazioni cliniche per l'enucleazione e l'esenterazione del bulbo oculare, l'insorgenza di complicazioni e l'esito a lungo termine nei bovini, nonché di esaminare l'atteggiamento dei proprietari nei confronti dell'enucleazione e dell'esenterazione e la loro soddisfazione per l'esito dell'intervento.

Le cartelle cliniche dei due ospedali veterinari in Svizzera sono state esaminate per identificare i bovini sottoposti a enucleazione o esenterazione unilaterale tra gennaio 2013 e dicembre 2020. I dati estratti comprendevano l'anamnesi, l'esame oculare, la diagnosi clinica, la procedura chirurgica, compresa l'anestesia, il materiale di sutura e la tecnica utilizzata, le complicazioni e il relativo trattamento. Il follow-up a lungo termine è stato valutato tramite indagini sul database nazionale degli animali per determinare il tempo di sopravvivenza e tramite interviste ai proprietari con l'uso di un questionario standardizzato che includeva domande riguardanti l'insorgenza di complicazioni e il motivo della macellazione, le prestazioni produttive e la qualità di vita percepita dopo l'intervento, le inquietudini, i fattori che hanno influenzato la decisione di procedere con l'intervento e la soddisfazione generale per il risultato. I dati sono stati sintetizzati utilizzando le statistiche descrittive e le eventuali differenze tra le variabili sono state analizzate utilizzando il test esatto di Fisher e il t-test non accoppiato. L'associazione è stata considerata significativa se il valore di  $p < 0,05$ .

Sono stati identificati 38 casi, con un'età media di 5 anni. In più della metà dei casi (55,3%) sono state diagnosticate lesioni oculari non neoplastiche, rappresentate da gravi traumi con perdita del contenuto del globo, rottura del globo con anamnesi di cheratoconjunctivite infettiva o ipopion, o malformazioni congenite. Nei restanti casi sono state diagnosticate lesioni neoplasti-

moïde oculaire, mélanome ou sarcome. Des complications après l'opération ont été signalées dans 29 % des cas, notamment infection postopératoire et récurrence du carcinome épidermoïde oculaire. Il n'y avait pas d'association significative entre le diagnostic et l'apparition de complications postopératoires ou la durée de survie.

L'intervention chirurgicale n'a pas semblé influencer les performances de production postopératoires des animaux ni la qualité de vie perçue. La plupart des propriétaires (92 %) étaient satisfaits du résultat de la chirurgie. L'apparition de complications postopératoires entraînant une augmentation des coûts globaux et l'abattage des animaux était la principale raison de la baisse de satisfaction des propriétaires.

**Mots clés:** bovins, chirurgie oculaire, énucléation, exentération, orbite, carcinome épidermoïde.

che, tra cui carcinoma oculare spinocellulare (OSCC), melanoma o sarcoma. Le complicazioni successive all'intervento chirurgico sono state riportate nel 29% dei casi e comprendevano infezioni postoperatorie e recidive di OSCC. Non è stata riscontrata alcuna associazione significativa tra la diagnosi oculare e la comparsa di complicazioni postoperatorie o il tempo di sopravvivenza.

L'intervento chirurgico non sembrava influenzare le prestazioni produttive degli animali dopo l'intervento o la qualità di vita percepita. La maggior parte dei proprietari (92%) era soddisfatta dell'esito dell'intervento. L'insorgenza di complicazioni post-operatorie che hanno comportato un aumento dei costi complessivi e la macellazione è stata la ragione principale della minore soddisfazione dei proprietari.

**Parole chiave:** bovini, chirurgia oculare, enucleazione, esenterazione, orbita, carcinoma spinocellulare

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