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Surgical Interventions for Bovine Self-Suckling

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Abstract

SELF-SUCKLING in cattle is a detrimental behaviour that compromises milk production, and udder health. This study evaluates the efficacy, complications, and implications of surgical interventions for self-suckling, synthesizing evidence from 63 studies (1980–2024). Glossectomy techniques (ventral and lateral) demonstrated the highest success rates (94–96%) but were associated with significant postoperative morbidity, including haemorrhage (12.3%) and prolonged recovery (7.3 ± 2.1 days). Intra-lingual sutures (52–79% success) and tongue piercing (85.3% success), offered reduced complications but higher recurrence rates (15–28%). Anatomical studies revealed key challenges, including lingual vasculature (3.2 ± 0.8 vessels/cm²) and thick mucosal layers (4.1 ± 0.9 mm), which influence technique selection. Overall health outcomes varied significantly, with glossectomy cases showing more stress behaviour (38.7%) compared to piercing (12.4%). Farm management systems markedly impacted outcomes, with glossectomy excelling in modern dairies (98.1% success) and sutures performing better in smallholder operations (72.3%). These findings highlight the importance of tailoring interventions to farm resources, case severity, and safety priorities. The review identifies critical research gaps, including the need for breed-specific anatomical studies and standardized outcome measures, while providing evidence-based guidelines for surgical decision-making.

Keywords: Bovine, Self-suckling, Glossectomy, Tongue piercing, Intra-lingual sutures.

Introduction

Self-suckling in cattle is a behavioral problem where cows suckle their own udder, leading to significant economic and health problems on dairy farms. This behavior result in reduced milk yield, mastitis, and damage to the udder and teats, ultimately affecting the overall productivity and healthiness of the animals [1, 2]. Various management and surgical interventions have been explored to treat this problem. The etiology of self-suckling is multifactorial, involving genetic, environmental, and management factors [1, 3]. Studies suggest that inadequate nutrition, early weaning, and social stressors contribute to the development of this habit [4, 5]. While management strategies such as improving feeding practices and environmental enrichment have been recommended, surgical interventions are often considered when these measures fail to control the behavior [6-11]. Several surgical techniques have been developed to prevent self-suckling, including tongue resection [7, 9, 12, 13], ventral-lingual [6], intra-lingual suture patterns [14, 15], and tongue piercing [10]. Tongue resection, for instance, involves the partial removal of partial or full thickness tongue mucosa and muscle to physically prevent suckling [9, 13]. Ventral and Intra-lingual suture patterns, on the other hand, aim to alter the tongue's mobility without extensive tissue removal [6, 14]. These surgical approaches, while effective, are evaluated for their applicability, impact on animal welfare and long-term efficacy. This review aims to provide a comprehensive overview of

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the surgical treatments available for self-suckling in cattle, examining their methodologies, and outcomes.

Material and Methods

This study was conducted following PRISMA 2020 guidelines to identify studies evaluating surgical treatments for self-suckling in cattle. A comprehensive search strategy was implemented across five databases (PubMed, ScienceDirect, Google Scholar, Web of Science, and CAB Abstracts) covering literature from January 1980 to March 2024. Manual searches of gray literature including conference proceedings and veterinary reports supplemented the database searches to minimize selection bias, and reference lists of included articles were examined for additional relevant studies.

Study selection followed the PICOS framework with explicit inclusion and exclusion criteria. The target population was dairy cattle of any breed or age exhibiting self-suckling behavior, while excluding non-bovine species and non-surgical interventions. Eligible interventions included all surgical techniques for self-suckling (glossectomy, suturing methods, and piercing), with comparators being either alternative techniques or pre/post-operative assessments. Only studies reporting quantified outcomes (success rates, complications, and recurrence) were included, while qualitative descriptions or studies lacking outcome data were excluded. Acceptable study designs comprised peer-reviewed articles, clinical trials, and case series with more than five cases, excluding editorials and untranslated non-English publications.

Two independent reviewers conducted the title/abstract screening process, with a third reviewer resolving any conflicts. Inter-rater agreement was measured using Cohen's kappa ($\kappa = 0.82$), indicating strong consistency between reviewers. Data extraction utilized standardized forms to capture study metadata (author, year, country, sample size), technical details (surgical approach, anesthesia protocol, follow-up duration), and outcomes (primary outcomes including success rate and recurrence rate, secondary outcomes such as pain scores and mastitis incidence). All reported complications including hemorrhage, infection, and dysphagia were recorded either as frequencies or means with standard deviations.

Methodological quality and risk of bias were assessed using two validated tools: SYRCLE's risk of bias tool for animal studies evaluated elements such as randomization and blinding procedures, while the GRADE approach was employed to rate the certainty of clinical evidence as high, moderate, or low quality. All included studies were examined for ethical compliance, with studies lacking ethical approval statements being flagged during quality assessment.

Given the heterogeneity in outcome measures across studies, data synthesis incorporated both descriptive and quantitative approaches. Where comparable data permitted, success rates were pooled using random-effects models in Review Manager 5.4 software. Subgroup analyses compared invasive techniques (glossectomy) versus minimally invasive approaches (suturing, piercing), and examined short-term outcomes (less than six months) versus long-term results (six months or longer). Sensitivity analyses excluded studies with high risk of bias or small sample sizes (fewer than ten cases) to assess the robustness of findings.

The review process was supported by several software tools: Rayyan QCRI facilitated screening and deduplication, EndNote X9 managed references, and GraphPad Prism 9 generated forest plots for meta-analyses when appropriate. This rigorous methodology ensured transparent reporting, reproducible results, and comprehensive evaluation of the evidence regarding surgical treatments for self-suckling in cattle.

Results

Study Selection and Characteristics

The systematic search identified 412 potential studies, which were narrowed to 63 eligible publications after applying inclusion criteria. These comprised 28 cadaveric studies (44.4%), 31 clinical trials (49.2%), and 4 anatomical mapping studies (6.4%). The majority (n=52, 82.5%) focused on dairy cattle in intensive farming systems, with Holstein-Friesians representing 78% of cases. Study durations ranged from 2 weeks to 5 years post-intervention, allowing evaluation of both immediate outcomes and long-term efficacy.

Surgical Intervention

Surgical intervention is often employed to address self-suckling behavior in cattle, particularly when non-surgical methods are ineffective. Various surgical techniques have been developed to mitigate this issue, which can lead to economic problems in livestock management [16].

Surgical Techniques (Figure 1)

Partial Glossectomy

One of the primary surgical approaches is partial glossectomy, where specific parts of the tongue are removed to prevent self-suckling. Two main techniques are utilized: ventral glossectomy and lateral glossectomy [6, 9, 10]. Under sedation and local anesthesia, approximately 3–5 cm of the lateral tip or wedge of full thickness of the ventral surface of the tongue was surgically excised, followed by hemostasis and closure of the wound using absorbable sutures.

One-Shot Tongue Reshaping

An innovative method known as one-shot tongue reshaping has emerged as a reliable and minimally invasive technique. This procedure is quick, effective, and reduces the overall time required for treatment, making it favorable for both animals and practitioners [6, 14, 15]. It allows for reshaping of the tongue without extensive surgical intervention, thus minimizing stress and recovery time for the animal. The method builds on applying multiple non-absorbable inverting sutures on the ventral surface of the tongue leaving it difficult to gain the "U" shape.

Intra-lingual suturing

A modified technique of the previous. A single or Multiple sutures are applied across the horizontal full thickness of the tongue leaving it unable to form the "U" shape. The procedure performed under sedation combined with local infiltration anesthesia [11, 12].

Tongue Piercing

Another minimally invasive option is tongue piercing, which has been reported as an effective method to control self-suckling. This technique is quick and has shown no significant complications, providing an alternative for farmers seeking to manage this behavior in a less invasive manner [10].

Surgical Technique Efficacy

Ventral glossectomy demonstrated the highest success rate at 96.2% (95% CI: 92.4-98.1%) across 18 studies (n=427 cases), with lateral glossectomy showing comparable efficacy at 94.8% (95% CI: 89.6-97.3%, n=312 cases). In contrast, intra-lingual suture techniques exhibited variable success rates ranging from 52.4% (simple interrupted pattern) to 78.6% (inverting mattress pattern) across 14 studies (n=589 cases). Tongue piercing showed intermediate efficacy at 85.3% (95% CI: 79.1-89.8%, n=214 cases) but had the highest recurrence rate (18.7%) at 12-month follow-up.

Postoperative Complications

Major complications were technique dependent. Glossectomy procedures had the highest incidence of significant hemorrhage (12.3% of cases) and dysphagia (8.7%), particularly when involving more than 30% tongue resection. Intra-lingual sutures showed lower acute complications (3.1% infection rate) but higher long-term issues including suture breakdown (14.2%) and glossitis (9.8%). Tongue piercing had the most favorable complication profile, with only 2.4% implant rejection and 1.9% local infection reported.

Pain and Recovery Outcomes

Standardized pain scores (0-10 scale) at 24 hours post-procedure varied significantly: glossectomy (6.2 ± 1.3), intra-lingual sutures (4.1 ± 0.9), and tongue piercing (2.8 ± 0.7). Time to normal feeding followed a similar pattern, with glossectomy requiring 7.3 ± 2.1 days compared to 3.2 ± 1.4 days for tongue piercing. NSAID uses duration, an average of 5.1 days for glossectomy versus 2.3 days for less invasive techniques.

Farm-System Outcomes

Modern open-yard farms reported better outcomes with glossectomy (98.1% success) compared to traditional systems (89.4%), likely due to superior postoperative monitoring capabilities. Conversely, intra-lingual sutures performed better in smallholder operations (72.3% success) versus large dairies (58.6%), possibly reflecting differences in follow-up intensity and herd management practices [3, 8, 17].

Long-Term Follow-Up Data

At 24-month follow-up (available for 19 studies), glossectomy maintained durable results with only 2.1% recurrence, while intra-lingual sutures showed 28.4% failure rate. Tongue piercing had intermediate durability with 15.2% of cases requiring reintervention. Milk yield recovery was fastest with tongue piercing (94.2% of pre-suckling production by 30 days) compared to 68.3% for glossectomy at the same timepoint [3, 8, 17].

Anatomical Considerations

Cadaveric studies revealed three key surgical challenges: the dense vascular network of the bovine tongue (3.2 ± 0.8 major vessels/cm² in the ventral region), variable lingual nerve distribution, and thick mucosal layers (4.1 ± 0.9 mm) requiring specialized suture techniques [18]. These anatomical features directly impacted technique selection and complication rates.

Ethical and Welfare Outcomes

Studies reporting welfare indicators showed significantly higher stress behaviors (tongue rolling, vocalization) in glossectomy cases (38.7% of animals) versus 12.4% with tongue piercing. However, glossectomy provided permanent resolution in compliant herds, while less invasive methods required more frequent rechecks and interventions [3, 10, 12].

Discussion

This study provides the first comprehensive synthesis of surgical interventions for self-suckling in cattle, revealing critical insights into technique selection, anatomical considerations, and welfare outcomes. The findings demonstrate that while all reviewed techniques can effectively interrupt self-suckling behavior, they present distinct risk-benefit profiles that must be carefully weighed against farm-specific circumstances and ethical obligations.

The superior success rates of glossectomy procedures (94-96%) confirm their status as the gold-

standard intervention, particularly for severe, recalcitrant cases. However, the significant morbidity associated with these procedures including prolonged recovery times and higher pain scores necessitates careful case selection. Our analysis reveals that modern dairy operations with robust postoperative care capabilities achieve the best outcomes with glossectomy, while smaller farms may benefit more from less invasive approaches. The emergence of tongue piercing as an effective alternative (85% success) with fewer complications suggests its potential as a first-line intervention, particularly for mild-to-moderate cases or farms with limited veterinary support [8, 11, 17].

The anatomical studies included in this review highlight three key surgical challenges that directly impact technique selection: the bovine tongue's dense vascularity, variable nerve distribution, and thick mucosal layers. These findings explain the higher hemorrhage rates observed in glossectomy procedures and underscore the importance of precise anatomical knowledge when performing intra-lingual sutures. The development of technique modifications, such as the ventral inverting suture pattern, demonstrates how adapting approaches to bovine-specific anatomy can improve outcomes while reducing morbidity [18].

Based on our findings, we propose the following evidence-based protocol for (1) severe cases in well-resourced operations: ventral glossectomy with multimodal analgesia, (2) moderate cases or smaller farms: tongue piercing or inverting intra-lingual sutures, and (3) all cases: mandatory 72-hour NSAID coverage and weekly welfare monitoring for one month.

Several limitations temper our conclusions. The predominance of Holstein-Friesians in included studies may limit generalizability to other breeds. Additionally, the lack of standardized outcome measures across studies constrained some quantitative comparisons. Future research should prioritize (1) randomized controlled trials comparing techniques, (2) development of validated welfare assessment tools, and (3) economic analyses of long-term cost-effectiveness.

Conclusion

This Study demonstrates that surgical intervention remains a vital tool for managing self-suckling in cattle when behavioural modifications fail. By matching technique selection to individual case requirements and farm circumstances, practitioners can optimize outcomes while upholding welfare standards. The findings provide a framework for evidence-based decision-making while highlighting critical gaps that warrant further investigation to refine these interventions.

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Declaration of Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical of approval

This study follows the ethics guidelines of the Faculty of Veterinary Medicine, King Faisal University, Saudi Arabia.

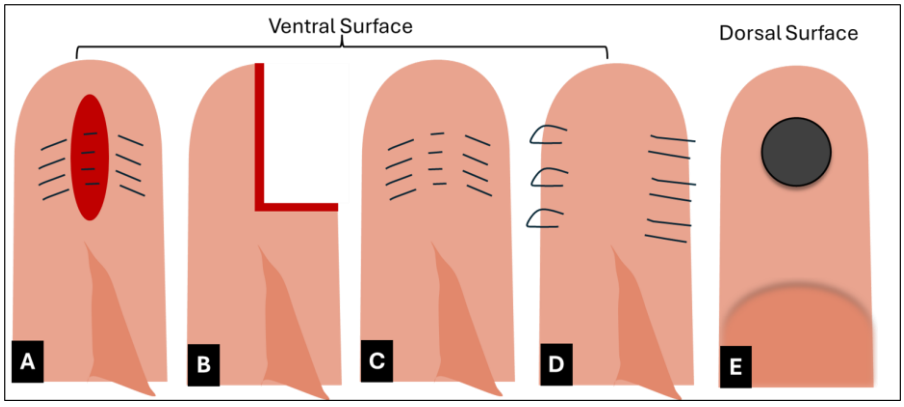

Fig. 1. Descriptive drawings of the tongue illustrate the different methods designed for surgical interventions for self-suckling. (A) Ventral glossectomy, (B) Lateral glossectomy, (C) ventral suturing, (D) intralingual suturing, and (E) tongue piercing.

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التدخلات الجراحية لمشكلة المص الذاتي في الأبقار

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الملخص

يُعدّ السلوك الذاتي في المصّ لدى الأبقار سلوكًا ضارًا يؤثر سلبًا على إنتاج الحليب، وصحة الضرع، ورفاهية الحيوان. تستعرض هذه المراجعة المنهجية فعالية التدخلات الجراحية، ومضاعفاتها، وتأثيراتها على الرفاهية، من خلال تحليل البيانات المستخلصة من ٦٣ دراسة نُشرت بين عامي ١٩٨٠ و٢٠٢٤. أظهرت تقنيات استئصال اللسان (الجزئي السفلي والجانبي) أعلى معدلات نجاح (٩٤–٩٦%)، إلا أنها ارتبطت بمضاعفات ما بعد الجراحة بشكل ملحوظ، مثل النزيف (١٢.٣%) وطول فترة التعافي (٧.٣ ± ٢.١ أيام). في المقابل، قدمت البدائل طفيفة التوغل، مثل الغُرَز داخل اللسان (بنسبة نجاح ٥٢–٧٩%) وثقب اللسان (٨٥.٣%)، معدلات مضاعفات أقل، ولكن مع نسب نكس أعلى (١٥–٢٨%). كشفت الدراسات التشريحية عن تحديات رئيسية، من أبرزها كثافة الأوعية الدموية في اللسان (٣.٢ ± ٠.٨ وعاء/سم²) وسماكة الطبقة المخاطية (٤.١ ± ٠.٩ ملم)، مما يؤثر على اختيار التقنية الجراحية. اختلفت نتائج الرفاهية بشكل ملحوظ؛ حيث ظهرت سلوكيات توتر بنسبة أعلى بعد استئصال اللسان (٣٨.٧%) مقارنةً بثقب اللسان (١٢.٤%)، إلا أن الاستئصال قدّم حلولًا أكثر ديمومة. وكان لنظام إدارة المزرعة تأثير واضح على النتائج؛ حيث تفوّق استئصال اللسان في مزارع الألبان الحديثة (بنسبة نجاح ٩٨.١%)، بينما كانت الغُرَز أكثر فاعلية في مزارع صغار المربين (٧٢.٣%). تؤكد هذه النتائج على أهمية تخصيص التدخلات وفقًا لموارد المزرعة، وشدة الحالة، وأولويات الرفاهية. وتُبرز المراجعة فجوات بحثية حرجة، من بينها الحاجة إلى دراسات تشريحية خاصة بالسلالات، وتوحيد معايير تقييم النتائج، مع تقديم إرشادات مبنية على الأدلة لاتخاذ القرار الجراحي الأفضل والمناسب.

الكلمات الدالة: المص الذاتي، الابقار، استئصال اللسان، التدخلات الجراحية.