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Advances in Surgical Management of Lameness in Dairy Cattle: A Review

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Introduction

Lameness is one of the most prevalent health problems in dairy herds, affecting welfare, milk yield, fertility, and longevity. The causes of lameness are multifactorial, including claw horn disruption lesions (sole ulcers, white line disease), infectious diseases (digital dermatitis, foot rot), joint infections, tendon injuries, and fractures. While preventive hoof trimming and medical management remain the cornerstone of control, surgical interventions are often required in advanced or non-responsive cases.

Over the past two decades, advances in surgical techniques, materials, and postoperative care have improved recovery rates and reduced economic losses associated with lameness. This review provides an overview of these developments.

Surgical Management of Claw Disorders

Corrective Hoof Surgery

When routine trimming fails to resolve claw lesions, partial surgical resection of affected horn or drainage of abscesses is performed. Recent advances include the use of dremel tools and high-speed burrs for precise removal of diseased horn, reducing trauma and speeding up healing.

Digital Amputation

Digital amputation remains an effective salvage procedure in cases of severe claw sepsis, osteomyelitis, or necrosis. The traditional guillotine method is increasingly replaced by disarticulation techniques at the distal interphalangeal joint, which minimize hemorrhage and provide better cosmetic healing. Use of electrocautery and ligation devices has further reduced intraoperative bleeding.

Claw Salvage Techniques

Instead of immediate amputation, partial resection of necrotic bone combined with orthopedic block application on the sound claw can preserve function. Advances in biomaterials, such as antimicrobial bone cements and local antibiotic delivery systems, have enhanced outcomes.

Management of Joint Infections and Arthritis

Arthrotomy and Lavage

Septic arthritis of the distal interphalangeal joint is a common sequela of claw infections. Arthrotomy followed by debridement and lavage has been refined with the use of arthroscopic-assisted techniques, which allow better visualization and reduced surgical trauma.

Facilitated Ankylosis

When joint preservation is impossible, facilitated ankylosis of the distal interphalangeal joint provides a long-term solution. Advances include the use of high-speed drills, osteotomes, and improved fixation devices, ensuring stability during the ankylosis process.

Tendon and Ligament Surgery

Flexor Tendon Resection

In cases of deep digital flexor tendon contracture or infection, partial resection is performed. Modern surgical approaches emphasize minimal invasion, combined with post-operative application of orthopedic blocks to relieve tension on the affected claw.

Tenosynovitis Management

Septic tenosynovitis often requires aggressive surgical debridement and drainage. Newer approaches involve regional limb perfusion with antimicrobials alongside surgery, improving outcomes and reducing systemic antibiotic use.

Orthopedic Surgery and Fracture Management

Fracture Repair

Fractures in cattle, though less common, are increasingly managed surgically in valuable dairy animals. Advances include:

- External skeletal fixation (ESF): Lightweight carbon-fiber rods and pin–clamp systems for better stabilization.
- Internal fixation: Use of locking compression plates and intramedullary pins in calves and heifers.
- Casting innovations: Fiberglass and polyurethane casting materials provide superior strength and lighter weight compared to traditional plaster.

Septic Osteomyelitis

Aggressive debridement followed by local delivery of antimicrobials through impregnated beads or biodegradable carriers has shown promise in managing osteomyelitis associated with claw infections.

Adjunctive Techniques in Wound Healing

Biological Dressings

Collagen sponges, honey dressings, and hydrogel pads are increasingly applied post-surgery to enhance wound healing and reduce infection risk.

Skin Grafting

For extensive skin loss after claw surgery or trauma, pinch or mesh grafts have been successfully adapted in cattle, improving functional recovery.

Laser Therapy

Low-level laser therapy is being explored for reducing inflammation, enhancing granulation tissue formation, and speeding epithelialization in surgical wounds.

Future Directions

Emerging trends in surgical management of lameness in cattle include:

- Regenerative therapies such as stem cells and platelet-rich plasma (PRP) for joint and tendon repair.
- 3D-printed orthopedic implants customized for bovine patients.
- Telemedicine and wearable sensors for postoperative monitoring of gait and healing.
- Precision surgery using AI-guided imaging for preoperative planning.

Conclusion

Surgical management remains an indispensable component in the treatment of lameness in dairy cattle, especially in advanced cases unresponsive to conventional methods. With improvements in claw surgery, joint management, fracture repair, and wound healing strategies, veterinarians now have a wider range of tools to preserve animal welfare and farm profitability. Future advances in regenerative medicine, biomaterials, and digital technologies are expected to further revolutionize bovine surgical orthopedics.