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Left Displaced Abomasum in Dairy Cattle: Current Concepts in Pathogenesis, Diagnosis, and Therapeutic Strategies

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Abstract

Left displaced abomasum LDA is one of the most common and costly metabolic digestive disorders of high producing dairy cows that mostly develops during the first month of postpartum. This review brings together existing knowledge of the multifactorial pathogenesis of LDA to go beyond simple models to stress the complexity of abomasal hypo motility, dietary factors, metabolic derangements and genetic predisposition. The period of transition is emphasized as the most critical that places the negative energy balance, hypocalcaemia, and subclinical ketosis together to instigate the deterioration of gastrointestinal functions. The correct diagnosis fully dependent on the typical ping which occurs with concomitant percussion and the use of listening is discussed with a supportive role of ultrasonography and clinical pathology which confirm the presence of displacement and evaluate the presence of metabolic complications. The critical review of modern treatment approaches is one of the focal points of this review. Surgical operation including the right flank omentopexy (Dirksen method), left flank abomasopexy and laparoscopic have been identified as the most effective treatment with the greatest success rate and least recurrence. Although percutaneous fixation techniques such as the toggle pin or the

blind stitch have some benefits (such as being cheaper and quicker) they are also associated with a high rate of complications such as peritonitis and failure. A comparative study of these methods has been provided to facilitate clinical decision-making in terms of case details and operator proficiency. Finally, the management of LDA should focus on a holistic approach that incorporates the timely and precise diagnosis with a proper therapeutic plan supported by strong transition cow management to eliminate the risk factors.

Keywords: *Left Displaced Abomasum, Dairy Cattle, Pathogenesis, Hypo motility, Diagnosis, Surgical Correction, Toggle Pin, Laparoscopy, and Transition Period.*

Introduction

Left displaced abomasum (LDA) is a widespread and exasperating illness in dairy cattle all over the world; it has always been among the three leading diseases, along with mastitis and lameness, to affect the profitability and good health of high producing dairy cows (Garvey, 2022). It is a disorder in which the abomasum, the actual glandular stomach of ruminants, is distended with gas and slides out of its usual location on the ventral abdominal floor to the left side where it gets stuck between the rumen and the left abdominal wall (Foulke & ElAshmawy, 2025). Clinical importance of LDA is not only limited to the immediate period of operation. It is a lack of success of the cow to manage the physiological stresses of the transition period which are the three weeks before up to three weeks after calving. Economic losses of LDA are enormous and manifold, as they are based on direct expenses on veterinary care, decrease in milk production that may not always reach projected levels, higher culling rates, and labor involved in the intensive care of diseased animals (Raghavi & Karthik, 2025). A case report that was released recently showed the deep economic effect estimating that the loss in revenue during withdrawal periods and loss in milk productivity on one cow would be greater than EUR 4,000 and that the direct costs of the surgical intervention would be minimal (Medeiros, Fernandez-Novo, Astiz, & Simões, 2022).

LDA etiology has largely been embraced as multidimensional, a complex interrelationship of nutritional, metabolic, genetic and management factors that interact in early post-partum period (Morselli, 2024). Over the decades, two main, usually interconnected, pathways have been studied, namely the process of excessive gas production in the abomasum and a decrease in its normal motility, resulting in atony and distension (Raghavi & Karthik, 2025). Initial hypotheses suggested that the build-up of volatile fatty acids and gases in the abomasum as a result of high levels of concentrates and low levels of effective fiber caused the abomasum to float and shift out of position

(Niehaus, 2024). Although this mechanical explanation does have a certain degree of merit, modern knowledge gives a far larger weight to abomasal hypo motility as the key precipitating factor (Yasaswini et al., 2023). This change of emphasis has been brought about by increased recognition of the radical metabolic changes which typify the period of transition (Flanagan & Goods, 2022). High producing dairy cow undergoes negative energy balance, prone to subclinical and clinical hypocalcaemia, and habitually faces associated illnesses such as mastitis (Arechiga-Flores et al., 2022). All these factors may either contribute independently or synergistically to impaired smooth muscle functioning, such as that of the abomasum and reticulum, which preconditions displacement (Raghavi & Karthik, 2025).

The astute clinician it has always been who, with a stethoscope and a firm finger with which to percussion, can come up with a diagnosis of LDA in the field (Bharadwaj, 2024). The archetypal ping which is heard on concomitant auscultation and percussion in the left flank is the key of diagnosis (Veklenko, 2024). Nevertheless, ruminal tympany and pneumoperitoneum are some of the differential diagnoses of a left sided ping that requires a careful clinical assessment (Foulke

& ElAshmawy, 2025). Ultrasonography has become an important adjunctive method in the last few years and this has made it possible to conclusively visualize the displaced abomasum and distinguish between ultrasound and other causes of tympany, thereby enhancing diagnostic accuracy, especially when dealing with more difficult or difficult cases (Alharbi, Rababa, Alsuwayl, Alsubail, & Alenizi, 2025).

The development of therapeutic measures used in LDA is an indicator of a constant search of effective, cost-effective (Das, Mazumdar, Khondakar, & Kaushik, 2025), and feasible therapeutic methods to both veterinarians and producers. Although conservative medical management, which includes starvation, exercise and rolling- which has been largely abandoned because of high recurrence, may still play a minor role in very early mild cases. The range of surgical procedures and skills is wide, both the more ancient, very invasive laparotomies through the flank and the modern, least invasive percutaneous fixation techniques (Bouboual, 2024). The debate on which technique is used frequently depends on the training and experience of the veterinarian, the facilities, the physiological condition of the cow and financial consequences. Two common open surgical methods to fix and repair the ovaries include the right flank omentopexy (Dirksen method) and the left flank abomasopexy (Hull method). These two methods have good exposure, and these are used to repair and correct the ovaries. Nevertheless, the current literature has taken a critical view of these approaches revealing certain serious risks of such complications as peritonitis, suture failure, and incomplete repair (Rosing & Latifi, 2025). This has led to a revival of laparoscopic procedures; which alleviate the disadvantages of percutaneous procedures with the advantages of visualization and the safety of an open procedure, and perhaps the best of both (Checcucci et al., 2022).

The objective of this review is the systematic overview of LDA in dairy cattle that would summarize the existing information on its complicated pathogenesis and perspective diagnostic methods (Esener, 2025). It will critically analyze the list of available therapeutic approaches, including surgical and conservative ones, and especially compare their results, risks, and the cost (Skou et al., 2022). This article aims to provide the conceptual framework required to manage and prevent this perennial dilemma in modern dairy production by backing up the principles that are already in place with the latest findings of research (Scholten, 2022).

Pathogenesis: A Multifactorial Cascade

The A left displaced abomasum is not an isolated event and hence it would be logical to assume that it is the final outcome of a chain of predisposing and precipitating factors that eventually result in abamasal malfunction and physical dislocation (Seluki, Seluki, Vaitkeviciene, & Jagelaviciene, 2023). A primary failure of abomasal motility, which is exacerbated by excessive gas buildup, is identified as the current consensus and this failure happens in a cow that is already anatomically and metabolically susceptible during the transition period (Tufarelli, Puvača, Glamočić, Pugliese, & Colonna, 2024).

The Central Role of Abomasal Hypomotility

The emptying of the abomasal lumen is a complex activity that is controlled by the enteric nervous system, the hormones, and the innate smooth muscle contractility (Furness, Pustovit, Fothergill, McQuade, & Stebbing, 2022). This process is now viewed as the sine qua non of LDA pathogenesis that leads to hypo motility or a failure to produce this. Several motile and functional abomasum can also propel gas and digest in an aboral fashion which helps to prevent the build-up which causes distension and displacement. There are a few determinants that interact in the postpartum phase to disable this motility (Schwartz & Villa, 2025).

Metabolic Derangements:

Subclinical hypocalcaemia or more significantly, Hypocalcaemia is a well-documented risk factor of LDA. Smooth muscle contraction needs calcium ions (Ametaj, 2025). Even a slight decrease in blood calcium during the period of parturition may lead substantially to the decrease in the intensity and frequency of abomasal and ruminal contractions (van den Bosch, Soede, Kemp, & van den Brand, 2023). Likewise, other causes of muscle weakness and impaired motility may be caused by hypokalemia which is usually a side effect of decreased feed intake and alkalosis (Felix, Pauline, Ogunkunle, & Lushaikyaa, 2024).

Concurrent Disease and Endotoxemia:

The initial days after childbirth are the period when a human body is extremely vulnerable to other conditions, including metritis, mastitis, and retained placenta. The systemic inflammation and endotoxemia of these conditions has a direct inhibitory effect on gastrointestinal motility. Moreover, the cows that have such comorbidities usually have low feed consumption (anorexia) that reduces the rumen fill and physically leaves more space in the abdominal cavity that allows the abomasum to move about (Felix et al., 2024).

Dietary Influences:

One of the significant nutritional stress factors is the dramatic changes in the composition of high forage, low energy dry cow diet in high-concentrate, energy-dense lactation diet. Introduction of high concentrate diets results in the generation of volatile fatty acids (VFAs) in the rumen and abomasum. High levels of VFAs especially propionate have been reported to have a direct inhibitory effect on the abama motility (Niehaus, 2024). In addition, the inadequate effective fiber in the diet will decrease rumination, buffering capacity, and rumen motility and fill, which makes the problem worse. The initial sluggish postpartum rise in a dry matter intake (DMI) only worsens the situation, keeping the rumen fill in a negative energy balance and low levels of dry matter intake (Hendriks, Bradford, & Brand, 2023).

The Contribution of Gas Accumulation

Although hypo motility is the major cause the gas accumulation is what makes the abomasum physically distend due to the accumulation, making it become buoyant and migrate (Raghavi & Karthik, 2025). The gas is not ruminal in nature and refluxing into the abomasum, but it is rather produced in large quantities (Reddy & Hyder, 2023). Fermentation of fast fermentable carbohydrates that cannot be rumenally digested may result in the generation of large volumes of carbon dioxide, methane, and other gases which may occur in-situ within the abomasum (Maurya & Bharti, 2025). This gas would in a normal, motile organ be periodically expelled or discharged through the intestinal tract (Shahsavari & Parkman, 2022). However, in hypo motile abomasum, it does build up hence causing distension. The gas filled organ can be made more buoyant and thus start to workers upwards, migrating along the left body wall, lateral to the rumen until it gets stuck in its typical LDA location (Maurya & Bharti, 2025).

Anatomical and Genetic Predisposition

The bovine abomasum is suspended freely in the ventral abdomen by the greater and lesser omenta, and has a measure of mobility that is used during displacement (Niehaus, 2024). Cows that are deep bodied and have a big abdominal cavity are more inclined physically to this migration because there is more room to be occupied by the abomasum (Niehaus, 2024). The estimates of the hereditability of LDA are moderate which proves a genetic constituent. Due to the selection of processes that are nearly entirely based on high milk production, more cases of LDA have been witnessed incidentally as the two traits are genetically related. The negative energy balance in the high producing cows is even more pronounced and the cows use more concentrate putting them at an increased risk (Mekuriaw, 2023).

The Transition Period as the Perfect Storm

Oppositely, more than 80 percent of the LDA cases are experienced during the early postpartum period, which is usually during the first month after calving onset . It is so since all the risk factors meet at this point. The cow experiences:

The gas distended, hypo motile abomasum combined with a roomy abdominal cavity and a cow in negative energy home gives the ultimate disaster of LDA (La Vacile & Lapte). The resulting partial blockage of the digesta flow results in the typical metabolic alkalosis whereby the hydrochloric acid is still secreted into the abomasum but this time it is sequestered together with the chloride ions causing hypochloremia and hypokalemia (Dabbir & Rajavolu, 2024). The most frequent complications associated with treatment are secondary ketosis and in more complicated or chronic-based, hepatic lipidosis, which complicate the treatment and worsen the prognosis.(Yong, Luo, Yang, Zhang, & Cao, 2025)

Diagnostic Strategies

LDA diagnosis usually can be easily done by an experienced clinician depending on the results of the physical examination (X. Chen et al., 2024). The main objectives of diagnosis include establishing the displacement, distinguishing it among other causes of abdominal tympany, and determining the metabolic status of the cow to use it to determine the prognosis and adjunctive therapy (Tharwat, Alkheraif, & Oikawa, 2025).

Physical Examination and the "Ping"

A resonant, high-pitched ping is the cardinal sign of an LDA that can be heard when performing simultaneous auscultation and percussion of the left abdomen (Veklenko, 2024). This is conducted by placing a stethoscope firmly against the flank over the region that is considered to be formed by a line between the tuber coxae (hook bone) to the point of the elbow and then to the stifle (Bandovic, Holme, Black, & Futterman, 2024). As the clinician listens, he or she flicked or banged the abdominal wall with a finger or the end of a percussion hammer (Ash, 2023), a couple of inches off the stethoscope head. The abomasum is filled with gas that serves as a resonating chamber making it produce a ping that is musical in nature (Raghavi & Karthik, 2025). In the case of LDA, the localization of this ping is usually between 9th and 13th ribs, between the middle and upper third of the left abdomen (Nip et al., 2025). Left sided ping differential diagnosis includes:

Rumen Gas Cap

This generates a more dorsal ping that usually extends farther caudally across the paralumbar fossa and it tends to be less resonant (Raghavi & Karthik, 2025).

Pneumoperitoneum

Free air in the abdominal cavity may lead to bilateral pings that change their positions with the movement of the cow (Zakir & Abdo, 2022).

Ventral Hernia

This is not very common and is accompanied by other palpable anomalies (Mondal & Bhave, 2023).

Additional auscultation of the region of the ping can also demonstrate high-pitched tinkling or splashing noises (Veklenko, 2024), in time with the respiratory movements of the cow or as a result of the mobility of the fluid inside the gas filled viscous (Sherwin, Nelson, Kerby, & Remnant, 2022). Simultaneously diagnosed conditions encompass anorexia (usually selective, including a refusal of grain but continuation of interest in hay), a decrease in milk production, a slight dehydration, and perhaps a decrease or lack of rumen contractions (Raghavi & Karthik, 2025). The feces can be runny and in most cases, sparse.

Adjunctive Diagnostic Tools

Although the ping is quite suggestive, other instruments may give confirmatory data and other useful information (Io, Wang, Wong, Li, & Zhong, 2023).

Ultrasonography

Trans abdominal ultrasound is a tool that has helped in the conclusive diagnosis of LDA (Hu, Sun, Feng, & Yu, 2023). The abomasum may be seen through a low frequency (3.5 MHz) convex probe over the location of the ping. It looks like a bulky, hypo echoic (dark) fluid and gas filled viscous having a typical folded wall appearance. Differentiation between the rumen and ultrasound is not difficult since the wall of the rumen is more echogenic (bright) because it consists of layered muscles and in addition papillary lining (Maurya & Bharti, 2025). It is especially applicable in distinguishing between LDA and a rumen gas cap when there is a grey case (Evangelista, Milanesi, Pietrucci, Chillemi, & Bernabucci, 2024).

Clinical Pathology (Blood Biochemistry)

Clinical Pathology (Blood Biochemistry): Blood work is not needed in the diagnosis but is required to investigate the severity of the situation and the presence of complicating metabolic factors that would determine the treatment and prognosis (Jha et al., 2023). A typical LDA biochemical profile consists of:

Hypochloremic Metabolic Alkalosis

It is the characteristic electrolyte and acid base disorder (Uppal, Workeneh, Rondon-Berrios, & Jhaveri, 2022). The sequestration of hydrochloric acid in the abomasum causes loss of chloride in the body (hypochloremia) and an increase of bicarbonate in the blood which causes alkalosis (Felix et al., 2024).

Hypokalemia: Potassium is excreted in the saliva and is sequestered in the abomasum, it is not taken in because of anorexia which results in low blood levels of potassium (Felix et al., 2024).

Ketosis: An increased blood or milk concentrations of betahydroxybutyrate (BHB) are typical, which is evidence of the negative energy balance and fat catabolism (Mekuriaw, 2023).

Azotemia: The results may be a high level of blood urea nitrogen (BUN) and creatinine, and dehydration and prerenal causes (Mekuriaw, 2023).

These parameters are important to be assessed (Xu, Xie, Qin, Tao, & Wang, 2026). A cow with severe alkalosis, marked hypokalemia, and high degree of ketosis will demand aggressive medical stabilization (e.g., intravenous fluids containing electrolytes and dextrose) as well as surgical correction in order to guarantee successful result (Silva & Marcos, 2025).

Therapy Procedures: A Critical Analysis

The use of LDA has developed greatly. Any therapy aims at re-positioning the abomasum back to its normal anatomical position and permanently securing it to avoid re-occurrence. Although the role of medical management is limited, the sole sure way of attaining this is through surgical intervention (Wan, Shi, Xiao, Li, & Mo, 2025).

Conservative and Medical Management

Conservative treatment, whereby the cow is rolled over on her back in order to enable the gas filled abomasum to rise to the surface is hardly recommended as a treatment in its own right (Niehaus, 2024). Although it may be able to correct it temporarily, it has the highest recurrence rate (around 5080 percent) due to the lack of treatment of the underlying hypo motility as well as the fact that no permanent fixation is done (Niehaus, 2024). Its application is mostly historical, but can be tried as a pre-surgical measure before surgical correction of some protocols (Niehaus, 2024). Medical therapy has the major role of being used as an addition to surgery. Isotonic fluids (e.g. 0.9% saline, very much chloride rich) are usually recommended as preoperative or intravenous fluid therapy to correct dehydration, hypochloremia and metabolic alkalosis. Fluid

replacement with potassium chloride, dextrose prevents hypokalemia and ketosis and prepares the patient to the anesthetic procedure and enhances post-operative recovery (Coviello & Servillo, 2025).

Open Techniques Surgical Correction

The open surgical technique, which is done through a laparotomy cut at the flank, is the most common form of LDA treatment over the decades and the one that other techniques are compared to (Zhao, Zhang, Yang, Zhou, & Xu, 2024).

Right Flank Omentopexy (Dirksen Method)

It is done by incision into the right paralumbar fossa (Li et al., 2022). The surgeon crosses the abdomen, in order to palpate and decompress the displaced abomasum with the insertion of a trocar or large gauge needle to release gas, and then manually attempts to reassure the abomasum back into its usual position (Gibbons, 2025). The abomasum is attached, not to the stomach itself, but to the greater omentum attached to it and sutured to the peritoneum and transverse muscles of the right body wall (Pesquera & Utrilla Contreras, 2025). This technique is very popular since it enables one to fully examine the abdomen to eliminate other related problems such as traumatic reticuloperitonitis or abomasal ulcers (Choudhary, 2024). It has a high level of success (>90%), and very little recurrence.

Left Flank Abomasopexy (Hull Method)

This is a procedure that involves surgery on the abomasum by utilizing a left flank incision (Jordan, 2025). When it is decompressed, the abamasal wall is stitched to the left body wall. It offers good direct visualization of the displaced organ and is of use especially in chronic situations where adhesions might have developed (J. Chen et al., 2023).

Minimally Invasive Techniques: Percutaneous and Laparoscopy

Percutaneous fixation techniques were developed as a result of the search of less invasive, faster, and more cost-effective forms (J. Chen et al., 2023).

Percutaneous Fixion (Toggle Pin or Blind Stitch)

It is done on a standing or recumbent cow by using either the Grymer/Sterner toggle or the so-called blind stitch (Schären-Bannert, Bittner-Schwerda, Rachidi, & Starke, 2024). Once the LDA has been located by means of ping, the abomasum is usually punctured with a needle (Yong et al., 2025). A trocar or a large needle, sharp or with suture or a plastic toggle pin is then pushed through the body wall and into the abomasum (Lozier, 2025). The toggle is released or the suture fastened, and then pulled taut, which fixes the abomasum to the body wall. Suture is looped and knotched over a roll of gauze or button upon the skin (Lozier, 2025).

Advantages

It is indisputable that these methods are fast, needless equipment, there are little direct costs and can be done on virtually any farm site (Karunathilake, Le, Heo, Chung, & Mansoor, 2023).

Disadvantages

The procedure has its major drawback in the fact that it is blind (Liu, Liu, Gu, Qiao, & Dong, 2022). A genuine risk of complications is present, comprising: failure to get into the abomasum, unintended puncture of the rumen, spleen, or liver, insufficient correction of the displacement, suture breakage and, most worryingly, localized or diffuse peritonitis at the fixation area (Hollingshead & Thomas, 2025). In a recent case report, a cow with a blind stitch procedure had severe complications that necessitated a second, expensive salvage surgery to repair peritonitis and adhesions (Yii, 2022). As much as these methods are still popular, they should only be used with a thorough case selection, a rigid adherence to protocol and one should be aware of the inherent risks associated with them (Sinha & Lee, 2024).

Laparoscopic Abomasopexy

This is a technological compromise (Bouzin, 2025). A surgeon can see the abomasum that has been displaced and the abdominal cavity using a laparoscope that is inserted through small holes (Niehaus, 2024). The abomasum is inspected directly and subsequently fixed, usually by an implant made of a special toggle or mesh (Iso, Uchiyama, Yamashita, Kuba, & Tsuka, 2025). This is a hybrid between the least invasive approach of the percutaneous techniques and the visualization and safety of the open surgery, which significantly helps to lower the risk of iatrogenic damage (Giorgi et al., 2025). The price of equipment and the much training needed to learn the technique are the greatest impediments to its mass application (Alzubaidi et al., 2023).

Conclusion

Left displaced abomasum is a persistent bane of contemporary dairy medicine and can be seen as overhead notification of the precarious physiological tolerance on which high-milk output is based. The pathogenesis of it has now grown up, and is no longer a mere mechanical failure, but a compound, multifactorial syndrome, based upon the metabolic and nutritional stresses of transition. The central lesion is abomasal hypo motility which is induced by hypocalcaemia, endotoxemia and high concentrate diets that permits the gas to be collected and the subsequent displacement of the organ. Good management, thus, pre-dates the clinical case by many years, establishing proactive transition cow programs that will enhance the optimal intake of dry matter, reduce negative energy balance, and eliminate co-morbidity. To the veterinary practitioner, the diagnosis of LDA is still a rewarding experience in using applied clinical skills, and the ping of the displaced abomasum acting as a ringing alarm. Although the diagnosis is usually a clear one, it is important to carefully examine the metabolism of the cow so that to provide it with supportive care and a good prognosis. The environment of curative choices is constantly changing. The most reliable and diagnostic method is the traditional flank laparotomies. It is not surprising that percutaneous blind methods are attractive in a busy business world, but after the recent reports of serious complications, the lesson is now being learned as to the critical role of operator expertise, case selection, and a candid analysis of their shortcomings. Where possible, laparoscopic procedures provide a beautiful combination of minimal-invasiveness and the visual control. Finally, the conservation of the surgical method should be a delicate decision, based on the case of the circumstance, the skills of the veterinarian and the farm facilities. This combined method of precise prevention, correct diagnosis and a careful, evidence based choice of therapeutic methods to recover health, protect welfare, and retain the productivity of the dairy cow is the future of the LDA management.

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