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Research Article

Acute intestinal torsion in dogs: Comprehensive clinico-pathological study

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Abstract

Acute intestinal torsion is a fatal gastrointestinal disorder in dogs resulting from twisting of the intestinal loops around the mesenteric axis, leading to vascular obstruction, ischemia and subsequent necrosis. The present study was conducted from April 2024 to May 2025 to investigate the clinico-pathological alterations associated with acute intestinal torsion in dogs subjected to post-mortem examination. A total of eight cases were documented in large-breed dogs of either sex, predominantly German Shepherds and Great Danes. Clinically, all dogs had a history of sudden onset of abdominal distension, restlessness, vomiting and rapid deterioration prior to death. Haematological evaluation based on available ante-mortem or clinical records revealed leucocytosis with neutrophilia, haemoconcentration and variable degrees of anaemia. Biochemical profiles showed significant elevation in liver enzymes (ALT, AST), blood urea nitrogen (BUN) and creatinine, indicating systemic shock with hepatic and renal compromise. Gross examination during necropsy revealed severe distension of the abdomen, torsion of the small intestine along the mesenteric axis, dark red to black congested intestinal loops and presence of blood-tinged fluid in the peritoneal cavity. Histopathological examination of the affected intestine exhibited severe vascular congestion, mucosal necrosis, haemorrhage and inflammatory infiltration, confirming acute intestinal torsion as the cause of death. The study highlights the diagnostic significance of post-mortem examination along with haemato-biochemical findings in confirming acute intestinal torsion in dogs. Early clinical recognition and prompt surgical intervention are strongly recommended to prevent fatal outcomes in predisposed large-breed dogs.

Keywords: Acute intestinal torsion, Clinicopathology, Dog, Haematology and biochemistry

Highlights

- Intestinal torsion - marked mucosal and villous disorganization
- Vascular changes - congestion, haemorrhage and dilated vessels
- Muscularis damage - edema and fibre separation observed
- Inflammatory response - minimal neutrophilic infiltration initially
- Ischemic injury - necrosis and tissue disruption due to torsion

INTRODUCTION

Acute intestinal torsion, also known as volvulus, is a rapidly progressive and often fatal condition in dogs characterized by twisting of the intestinal loops around the mesenteric axis, leading to complete obstruction of the intestinal lumen and mesenteric blood vessels (Rautala et al., 2017; Fossum, 2018). This results in compromised blood flow, ischemia and necrosis of the affected intestinal segments, ultimately causing hypovolemic shock and death if not corrected promptly. It is a major cause of acute abdominal emergencies and sudden mortality in dogs, with a higher incidence in large and deep-chested breeds.

Breed predisposition has been reported in German Shepherds, Great Danes, Doberman Pinschers and Labrador Retrievers, which are more prone due to their deep thoracic conformation and greater mobility of the gastrointestinal tract (Hall et al., 2017; Czajkowski & Fryer, 2020). Males are slightly more affected than females, and the condition commonly occurs in adult to aged dogs. Hereditary and conformation-related factors such as narrow thoracic inlet, increased ligamentous laxity and excessive gastric distension following heavy feeding or exercise have been suggested as contributing causes (Brockman et al., 1995; Tivers & Brockman, 2009).

Dietary and managemental factors play a crucial role in the pathogenesis. Feeding large meals once daily, rapid ingestion of food and diets rich in fermentable carbohydrates can predispose dogs to excessive gas formation and intestinal displacement (Elwood, 2017). Similarly, hormonal influences particularly alterations in motilin and gastrin levels have been hypothesized to affect gastrointestinal motility and predispose susceptible dogs to torsion (Holt & Brockman, 2016).

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Clinically, affected dogs exhibit sudden onset of abdominal pain, distension, vomiting, restlessness and collapse progressing rapidly to circulatory shock and death if surgical intervention is delayed (Nelson & Couto, 2020). Laboratory findings typically reveal leucocytosis, haemoconcentration, elevated liver enzymes (ALT, AST) and azotemia reflecting dehydration, systemic inflammation and multi-organ compromise (Sharma et al., 2019).

At necropsy, the twisted intestinal loops appear dark red to black, distended and congestedwith blood-tinged fluid in the abdominal cavity. Histopathologically, lesions are characterized by severe vascular congestion, mucosal necrosis, haemorrhage and neutrophilic infiltration (Vegad, 2021). Post-mortem examination remains a valuable tool for definitive diagnosis in cases of peracute death where clinical management is not possible.

The present study was undertaken to document the gross, histopathological, haematological and biochemical alterations associated with acute intestinal torsion in dogs presented for post-mortem examination over a one-year period (April 2024 to May 2025) at the Department of Veterinary Pathology, Bihar Veterinary College, Bihar Animal Sciences University, Patna. The study aims to enhance understanding of the pathological mechanisms, systemic responses and risk factors involved in intestinal torsion, thereby supporting improved diagnostic and preventive strategies in canine gastrointestinal emergencies.

MATERIALS AND METHODS

This study was designed as a retrospective clinico-pathological case series based on post-mortem examination of dogs diagnosed with acute intestinal torsion.The present study was conducted on eight cases of acute intestinal torsion in dogs that were presented for post-mortem examination to the Department of Veterinary Pathology, Bihar Veterinary College, BASU, Patna, during the period from April 2024 to May 2025. The carcasses were received from the Teaching Veterinary Clinical Complex and surrounding private veterinary practices. Dogs of different large breeds, predominantly German Shepherds and Great Danes of either sex and varying ages were included in the study.

As per the case history provided by owners, most dogs had shown a sudden onset of abdominal distension, restlessness, repeated vomiting, anorexia and rapid deterioration leading to death within a few hours. In a few cases, signs of painful abdomen, tympany and unproductive retching were observed before death. All the carcasses were examined within 4–6 hours of death to avoid autolytic artefacts.

A thorough systematic necropsy examination was carried out following standard protocols described by Luna (1968). The abdominal cavity was carefully opened, and observations were recorded regarding position, colour and consistency of the intestinal loops, presence of torsion along the mesenteric axis and changes in adjacent organs. Gross lesions such as distension of intestinal loops, dark red to black discolouration, congestion, haemorrhage and serosanguinous fluid accumulation were documented and photographed. The degree and direction of torsion were noted in each case.

Representative tissue samples from the affected intestine were collected in 10% neutral buffered formalin for histopathological examination. The fixed tissues were processed by the routine paraffin embedding technique, sectioned at 4–5 µm thickness and stained with Haematoxylin and Eosin (H&E) as per the method of Luna (1968) for microscopic evaluation.

Available haematological and biochemical values of the affected dogs obtained from clinical records prior to death were analysed wherever accessible. Haematological parameters such as haemoglobin concentration, packed cell volume (PCV), total erythrocyte and leukocyte counts were evaluated using standard methods (Weiss et al., 2010). Biochemical parameters, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), blood urea nitrogen (BUN), creatinine and total protein were assessed using an auto-analyzer with commercial diagnostic kits.

All the observations were recorded systematically, and the necropsy findings were correlated with the available clinico-pathological data to confirm the diagnosis of acute intestinal torsion. The study emphasized post-mortem confirmation and pathological characterization of the condition in large-breed dogs.

RESULTS

All the affected dogs included in the present study were found dead or succumbed shortly after exhibiting acute abdominal symptoms before any surgical intervention could be attempted. The carcasses were presented for necropsy examination within 4–6 hours of death. Clinical records indicated that most dogs showed a sudden onset of abdominal distension, restlessness, vomiting, and collapse within a few hours prior to death.

During necropsy, the abdominal cavity was opened to reveal twisted segments of the intestine along with the liver. The intestine appears congested and edematous, indicative of vascular compromise; while

associated organs showed secondary congestion due to torsion (Fig. 1). Lungs showed multiple black coagulated spots that consistent with focal haemorrhage and congestion suggestive of severe vascular compromise (Fig. 2). The spleenswere markedly enlarged, swollen and congested reflecting underlying vascular congestion (Fig. 3). Gross examination of the intestines showed acute torsion. The affected intestinal segment was found to be twisted around its mesenteric axis, resulting in marked congestion, edema and discolouration. The serosal surface appeared dark and engorged with evidence of compromised blood flow (Fig. 4).The small intestinal loops were twisted along the mesenteric axis, varying from 180° to 360° and appeared dark red to black, markedly congested and distended with gas and fluid contents. The mesenteric vessels were engorged and fibrinous adhesions were observed in a few cases. The serosal surfaces of the intestines were dull and showed patchy haemorrhages. The mesentery was thickened and oedematous. In some carcasses, secondary changes such as congestion and enlargement of the liver, dark discolouration of kidneys and pulmonary congestion and oedema were also evident. The stomach in several dogs showed varying degrees of distension and the spleen appeared enlarged and congested.

Available ante-mortem clinical records revealed leucocytosis (14.5±1.3×10³/µL) with neutrophilia, haemoconcentration (PCV 48.6±2.5%) and moderate anaemia in some cases (Table 1). Biochemical alterations included elevated ALT (95.4±8.2 U/L), AST (126.2±10.4 U/L), BUN (38.6±4.1 mg/dL) and creatinine (2.3±0.3 mg/dL), indicating hepatic and renal compromise secondary to circulatory shock. Total protein and albumin levels were reduced (5.1±0.4 g/dL and 2.3±0.2 g/dL, respectively), suggestive of protein loss and vascular leakage (Table 2).

Table 1. Haematological profiles of 8 dogs suffering from acute intestinal torsion

Parameter	Mean ± SE	Reference Range *Weiss and Wardrop (2010).	Remarks
Haemoglobin (g/dL)	10.4±0.6	12–18	Mild anaemia
Packed Cell Volume (PCV, %)	48.6±2.5	37–55	Haemoconcentration due to dehydration
Total Erythrocyte Count (×10⁶/µL)	5.6±0.4	5.5–8.5	Within lower normal limit
Total Leukocyte Count (×10³/µL)	14.5±1.3	6–17	Leucocytosis
Neutrophils (%)	84.3±2.1	60–77	Neutrophilia indicating acute inflammatory response
Lymphocytes (%)	11.8±1.4	12–30	Mild lymphopenia (stress response)
Monocytes (%)	3.4±0.6	3–10	Within normal limits
Eosinophils (%)	0.5±0.1	2–10	Decreased (stress-induced)

Table 2. Biochemical profiles of 8 dogs suffering from acute intestinal torsion

Biochemical Parameter	Mean±SE	Reference Range* Kaneko et al. (2008).	Remarks
ALT (U/L)	95.4±8.2	21–102	Mild to moderate increase (hepatic involvement)
AST (U/L)	126.2±10.4	23–66	Markedly elevated (hepatic/muscle injury)
Alkaline Phosphatase (U/L)	135.8±12.1	20–156	Within upper normal range
Total Protein (g/dL)	5.1±0.4	6.0–8.0	Decreased (protein loss through vascular leakage)
Albumin (g/dL)	2.3±0.2	2.6–3.3	Decreased
BUN (mg/dL)	38.6±4.1	7–27	Elevated (renal involvement due to shock)
Creatinine (mg/dL)	2.3±0.3	0.5–1.8	Elevated (prerenalazotemia)
Total Bilirubin (mg/dL)	0.9±0.1	0.1–0.6	Slightly increased (hepatic congestion)
Glucose (mg/dL)	64.5±5.2	65–110	Slightly decreased (terminal hypoglycemia)



Fig. 1. Gross view of a dog with acute intestinal torsion. The abdominal cavity is opened to reveal twisted segments of the intestine along with the liver. The intestine appears congested and edematous indicative of vascular compromise while associated organs show secondary congestion due to torsion



Fig. 2. Gross examination of the lungs showing multiple black coagulated spots. These lesions indicate focal haemorrhage and congestion suggestive of severe vascular compromise



Fig. 3. Gross appearance of an enlarged spleen (splenomegaly). The organ is markedly swollen and congested reflecting underlying vascular congestion



Fig. 4. Gross examination of the intestine showing acute torsion. The affected intestinal segment is twisted around its mesenteric axis resulting in marked congestion, edema and discoloration. The serosal surface appears dark and engorged with evidence of compromised blood flow

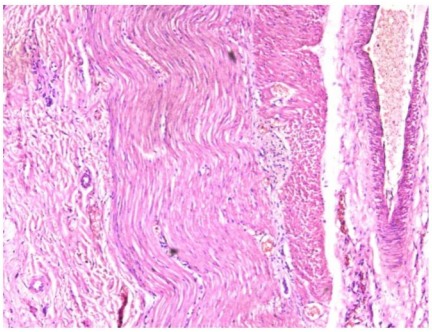


Fig. 5. Histological section of intestine of Dog (H&E, 10x) showing severe vascular congestion, haemorrhage and wavy arrangement of smooth muscle fibers in the muscularis layer indicating ischemic changes associated with acute intestinal torsion

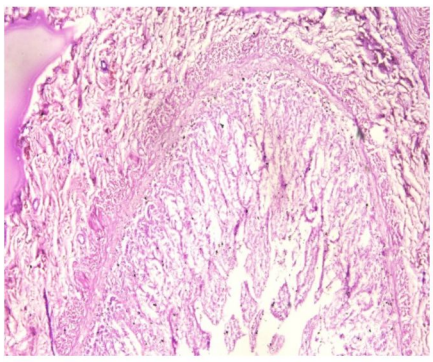


Fig. 6. Histological section of intestine of dog (H&E, 10x) shows marked villous blunting, congestion and necrosis of mucosa. The submucosa and muscularis propria exhibit edema and fibre separation. Dilated and congested blood vessels with focal haemorrhage are evident, accompanied by minimal neutrophilic infiltration. Overall, the normal intestinal architecture is disrupted, reflecting ischemic injury due to torsion

Microscopic examination of the affected intestinal segments (H&E, 10×) revealed severe vascular congestion, haemorrhage and necrosis of the mucosal and submucosal layers (Fig. 5). The intestinal villi were blunted or completely denuded and the epithelial cells exhibited karyorrhexis and cytoplasmic vacuolation (Fig. 6). The lamina propria and submucosa showed extensive oedema and infiltration of neutrophils, lymphocytes and macrophages. Fibrin deposition and occasional bacterial colonies were also observed in severely affected areas. Higher magnification (H&E, 40×) revealed complete loss of mucosal integrity with sloughing of necrotic epithelium, dilated blood vessels and fibrin thrombi within small capillaries.

Based on the gross, histopathological and clinico-biochemical findings, the condition was conclusively diagnosed as acute intestinal torsion leading to fatal circulatory shock and multi-organ dysfunction in large-breed dogs.

DISCUSSION

Acute intestinal torsion is an infrequent but highly fatal gastrointestinal emergency in dogs characterized by rotation of the intestinal loops around the mesenteric root resulting in vascular obstruction, ischemia and subsequent necrosis of the intestinal wall. In the present study, all cases occurred in large-breed dogs such as German Shepherds and Great Danes, which corroborates earlier reports indicating that deep-chested and large-breed dogs are more predisposed to intestinal torsion due to greater abdominal space and increased mobility of intestinal loops (Ettinger et al., 2017; Theyse & Ruaux, 2024). Clinical signs encountered in intestinal volvulus are weakness, recumbency, abdominal pain and distension and shock in acute cases (Spevakow et al., 2010), which were in accordance with the present case. Clinically, most affected dogs had a history of sudden abdominal distension, restlessness and vomiting followed by rapid deterioration and death consistent with the acute and fulminant nature of the condition reported by (Fossum, 2018). Haematological findings revealed leucocytosis with neutrophilia, haemoconcentration and variable anaemia changes attributed to systemic inflammatory response, fluid loss and circulatory shock as described by (Jain, 1986; Kaneko et al., 2008). Biochemical alterations such as elevated AST, ALT, BUN and creatinine values observed in this study are in agreement with earlier observations by (Theyse & Ruaux, 2024) indicating secondary hepatic congestion and renal dysfunction due to hypoxia and reduced perfusion associated with shock. In intestinal volvulus even with surgical intervention, death from hypovolaemia, sepsis and toxic shock is the usual consequence (Gillespie et al., 2011). Halfacree et al. (2006) further added that intestinal volvulus has a highly guarded prognosis. Deaths in present cases was most likely attributable to hypovolemia, septicemia and delay in surgical intervention because of delayed presentation.

Grossly, the torsed intestines were markedly distended, congested and dark red to black in colour with blood-tinged peritoneal fluid comparable to descriptions by Maxie (2016) who emphasized the diagnostic value of these post-mortem changes. Histopathological examination revealed severe vascular congestion, mucosal necrosis, haemorrhage and inflammatory infiltration, confirming acute ischemic damage. These findings are consistent with the classic pathological features of intestinal torsion (Ettinger et al., 2017). Progressive luminal distension with gas and haemorrhagic fluid ultimately leads to intestinalinfarction, breakdown of the mucosal barrier and translocation of bacteria and endotoxins into the systemic circulation (Golshahi et al., 2014).

The present study reaffirms that post-mortem examination plays a crucial role in confirming the diagnosis of acute intestinal torsion, particularly in peracute fatal cases where ante-mortem diagnosis is difficult. Early clinical suspicion, rapid radiographic evaluation and immediate surgical correction are strongly recommended to prevent irreversible circulatory collapse and death in predisposed large-breed dogs.

In most cases, death occurs before effective treatment can be initiated. The study underscores the diagnostic importance of necropsy in establishing the definitive cause of sudden death in dogs suspected of acute intestinal torsion and highlights the need for preventive measures through dietary management and monitoring of predisposed breeds.

Conflict of interest: The authors declare that they have no conflict of interest.

Author's contribution: VKS, DK: Conception and design**;** DK, KK, VKS: Performed statistical analysis of data**;** DK, KK, VKS: Performed interpretation of the results. All authors have approved the final submitted version. All authors approved to submit the article.

Data availability statement: The data set generated during research will be available from the corresponding author upon reasonable request.

Ethical approval: All procedures were conducted following institutional biosafety norms and ethical guidelines approved by the Institutional Animal Ethics Committee (IAEC), Bihar Veterinary College, BASU, Patna (Approval No.: IAEC/BVC/2025/29).

Use of artificial intelligence tools: The author(s) used no artificial intelligence tools during the preparation of this manuscript.

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