

# Scoping review: Occurrence and definitions of postoperative complications in equine colic surgery

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## Abstract

**Background:** Postoperative complications frequently occur following equine colic surgery but there is a lack of consistency in their definitions and reporting.

**Objectives:** To perform a scoping review to identify current evidence on the definitions and classifications of postoperative complications in equine colic surgery.

**Study design:** Evidence review.

**Methods:** A scoping review was conducted in CAB, Web of Science, Scopus and PubMed databases using a PCC (Population-equids, Concept-complications, adverse events, sequelae, failure to cure, technical failure, disease progression and Context-postoperative period after colic surgery) search strategy. Peer-reviewed scientific articles in the English language on equine colic surgery in live client-owned equids between 1992 and 2022 were included. The resulting references were independently and blindly screened by two investigators. Relevant data on the study method, sample size, intestinal tract involvement and postoperative complications were extracted and charted.

**Results:** Among 5850 articles potentially eligible, 272 met the final inclusion criteria. The most frequent types of study design were retrospective cohort studies (121/272) and retrospective case series (82/272). Median sample size was 53 animals, range 3–896. Seventy-nine of 272 (29%) studies reported diseases of the small intestine, 65 of 272 (24%) of the large intestine and 128 of 272 (47%) reported both. Seventy-two studies (26.4%) focused on single complications. No study explicitly defined the term complication or cited a classification of complications. One study reported the definitions of ‘sequela’, ‘progression’ or ‘recurrence’ of lesions. Eighty-one postoperative complications were reported in two-time frames defined as short- and long-term. The definitions of most complications and long-term follow-ups were highly variable.

**Main limitation:** Non-English language studies or conference proceedings were excluded.

**Conclusion:** There was a substantial lack of classifications of postoperative complications. The definitions of complications were highly variable, making it difficult to compare studies. Adopting classification systems and definitions may help surgeons

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to obtain a complete picture of the efficacy of a procedure or treatment and allow comparisons between studies, centres or time periods.

#### KEYWORDS

colic, horse, postoperative complications, scoping review, surgical colic

## 1 | INTRODUCTION

Equine colic is a major cause of mortality in the equine population, and its surgical treatment carries the risk of complications.<sup>1</sup> While advancements in surgical techniques, anaesthetic management and postoperative care have improved, mortality has not changed consistently in the last 30 years.<sup>2</sup> Postoperative complications in equine colic surgery are common, have important welfare and economic consequences, and may negatively impact horse survival or future athletic use. Although studies have investigated postoperative complications, the results are often contradictory.<sup>1</sup>

Studies on equine colic often focus on one complication that occurs after surgery, without considering the many other complications that may occur and affect the outcome of the procedure. Furthermore, complications associated with equine colic surgery may be related to a wide range of diseases, sometimes involving organs other than the gastrointestinal system, such as postoperative laminitis and pneumonia. Equine surgeons need a complete analysis of all complications that could arise after colic surgery to fully evaluate the success of treatment or surgical techniques and to clearly communicate with owners and referring vets. Thus, the reporting of such events by scientific studies requires completion and organisation.

The categorical assessment of the safety and quality of a surgical procedure by collecting relevant data on outcomes in a standardised and reproducible manner is important to compare adverse surgical outcomes across different centres, studies and therapies over time.<sup>3,4</sup>

Adverse surgical events can be divided into sequelae, procedural failures and complications.<sup>3</sup> Surgical sequelae are negative outcomes inherent to a given procedure. Surgical failures (technical error, failure to cure and technical failure) are events in which the purpose of the procedure is not fulfilled. Surgical complications are unexpected negative outcomes of a given procedure.<sup>3,5</sup>

Standardised data collection methods for these adverse events are useful for appropriately interpreting these events, comparing outcomes and facilitating clear communication of research results to owners and referring vets.<sup>3,4</sup> Since 1992, several classification systems for postoperative complications have been developed to report clinical research results in human surgical practice.<sup>3,5-7</sup> This standardised approach may improve the quality of systematic reviews and multicentre studies on surgery.<sup>3,4</sup> Some validated grading systems for adverse surgical outcomes exist in veterinary medicine and have been proposed mostly for small animals.<sup>4,8-13</sup> However, there appears to be a lack of knowledge of these standardised criteria in defining and classifying surgical adverse events in general, as well as complications, particularly in veterinary medicine. Moreover, no such effort has been made in equine surgery.

Therefore, this perceived lack of clarity over postoperative complication definitions and classifications, as well as the broad distribution of publications on this topic, lends this body of literature to a scoping review. A scoping review is a type of evidence review that provides an objective methodology to search literature and a broad overview of a specific topic. Scoping reviews do not perform any critical analysis of the studies identified, but through methodological database searching they can produce a map of the literature, identify and clarify key concepts, investigate research conduct and reveal knowledge gaps in a body of literature.<sup>14,15</sup> Scoping reviews produce extensive charting to produce a map of the literature and can be used to identify and clarify definitions. This type of review can also be used to investigate research and identify knowledge gaps regarding postoperative complications in studies on equine colic surgeries.

This study reviewed the literature on postoperative complications reported in clinical research studies of colic surgery in horses over the last 30 years. The primary objective was to quantify how often each postoperative complication was reported in the literature, how often the term 'complication' was defined, and how often complications were categorised and graded for severity. We also summarised the complications and the definitions used for each complication. Finally, we quantified how often the terms 'adverse events', 'sequelae', 'progression of disease', 'failure to cure', 'technical failure' and 'technical error' were reported and defined in the literature to eventually differentiate them from complications.

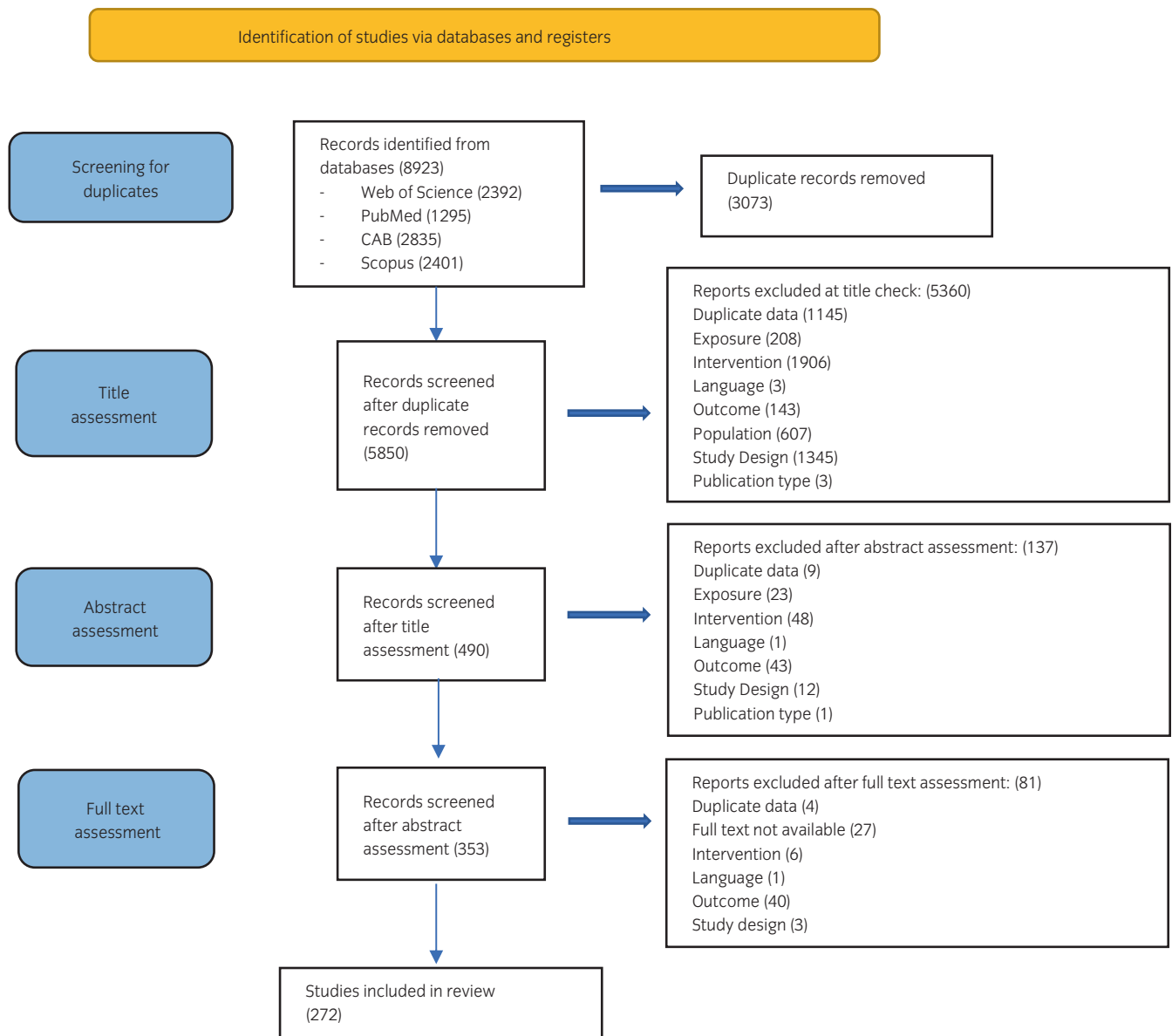
## 2 | MATERIALS AND METHODS

### 2.1 | Protocol and registration

This review was conducted in duplicate by two researchers according to the Preferred Reporting Items for Systemic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).<sup>16</sup> The protocol was registered at the OSF Registries and can be downloaded at the following link: [https://osf.io/c3e2j/?view\\_only=93fc59fe7649447daaac35a1eb364500](https://osf.io/c3e2j/?view_only=93fc59fe7649447daaac35a1eb364500). All authors provided input and review of the database search strategy. Any disagreements between the two researchers were resolved by a third independent reviewer.

### 2.2 | Eligibility criteria

The exclusion criteria were used to facilitate the search strategy. Peer-reviewed scientific articles in the English language that studied



**FIGURE 1** Flow diagram outlining the process used to identify studies on outcomes after colic surgeries following a systematic review of the available literature.

equine colic surgery in live client-owned horses, mules and donkeys between 1992 and 2022 were eligible for inclusion. Studies that described or compared cases of animals with colic, reports on >3 animals, and articles about ventral or flank laparotomy for gastrointestinal disease were included. Studies of animals subjected to laparotomy for grass sickness were excluded. Articles were excluded if the surgical procedure was performed on healthy animals for experimental purposes.

### 2.3 | Information sources and search strategy

We searched for eligible articles in April 2022 in the CAB, Web of Science, Scopus and PubMed databases. The search was integrated and updated in June 2022.

Search combinations were constructed from the following components using a PCC (population, concept and context) search strategy according to the JBI guidelines (<https://jbi-global-wiki.refined.site/space/MANUAL/4687737/11.2.2+Developing+the+title+and+question>).

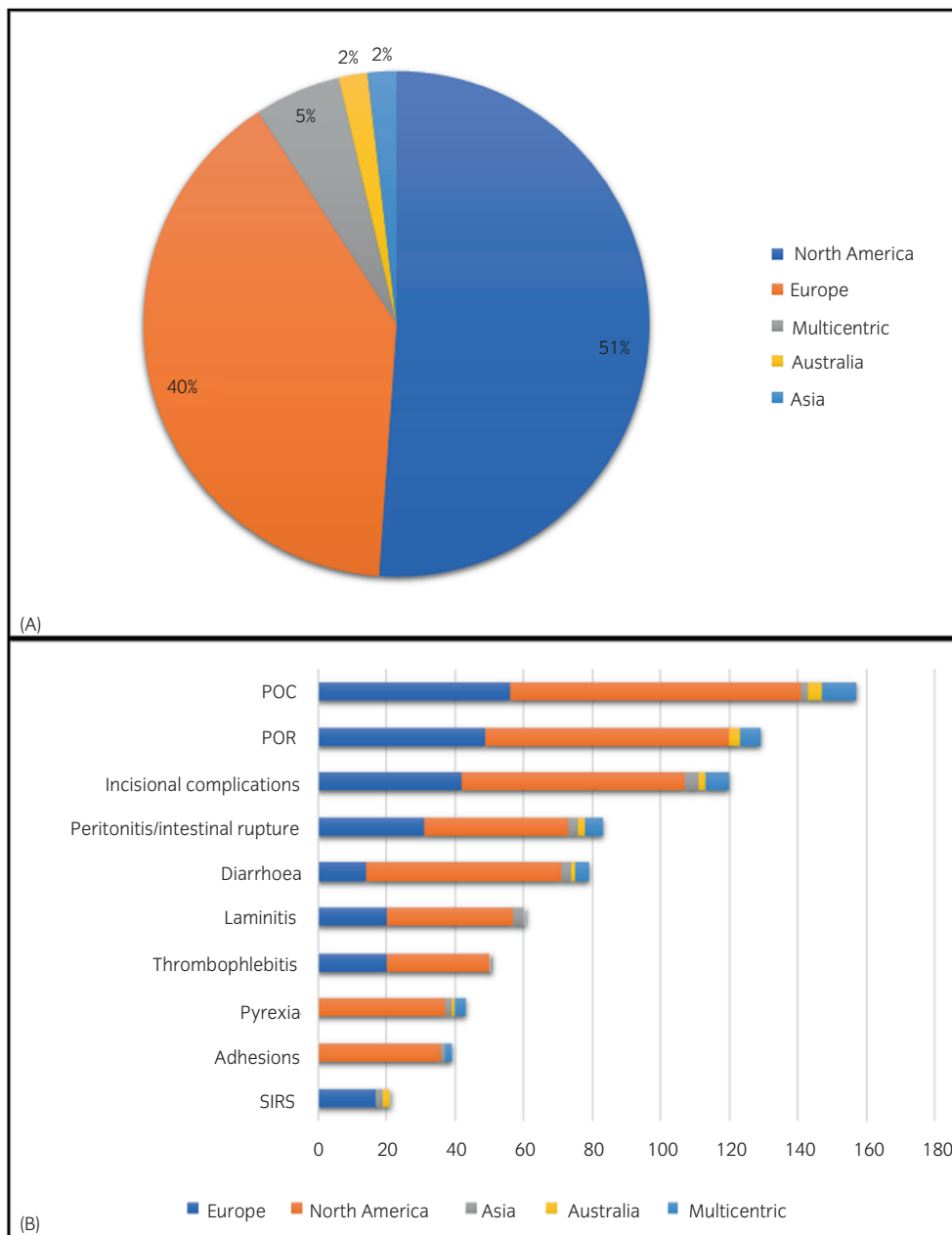
Population: horses, donkeys, mules (equids).

Concept: complications, adverse events, sequelae, failure to cure, technical failure and disease progression.

Context: postoperative period after colic surgery.

The resulting search string was as follows:

- (horse OR equine OR mule OR donkey OR equid) AND (colic OR (abdominal AND pain) OR (gastrointestinal AND disease) OR laparotomy OR celiotomy OR (colic AND surgery))
- years = '1992-2022'



**FIGURE 2** (A) Distributions of study types related to postoperative complications after colic surgery. (B) Trends of publication types on postoperative complications after colic surgery in equids (1992–2022). PCs, prospective case series; PCTs, prospective clinical trial study; Pos, prospective observational study; RCC, retrospective case-controlled study; Rco, retrospective cohort study; RCs, retrospective case series

- language = 'English'
- publication type = 'journal article'

The details of the search strings for each database are detailed in Data S1.

The resulting references were downloaded and managed with Clarivate Endnote Online (<https://access.clarivate.com/login?app=endnote>).

## 2.4 | Selection of sources of evidence

Duplicate studies were automatically removed using the relevant End-Note Online tool. The resulting articles were independently and blindly screened for eligibility by two investigators (MG, AC) based on

the titles, abstracts and full texts, as required. Any disagreement between the two researchers was resolved by a third researcher (GG).

## 2.5 | Data charting process

The full-text studies were independently analysed by two researchers (MG, AC), and relevant data were extracted into charts. Chart headings, publication categorisation and classification were determined and a consensus was reached after discussion with all researchers. Data on the study characteristics were extracted under the following headings: complete article citation, sample size, portion of the intestinal tract involved (small intestine, large intestine, or both), focus on a single complication, population and surgical technique or pathology. Data on complications were charted into four categories: resolved

**TABLE 1** Reported complications occurring during hospitalisation that were resolved with medical therapy before discharge after colic surgery in equids.

Complication	No. of papers	% of papers
Postoperative reflux	122	44.9
Incisional complications	120	44.1
Postoperative colic	90	33.1
Surgical site infection	80	29.4
Diarrhoea	78	28.7
Thrombophlebitis	53	19.5
Pyrexia	52	19.1
Laminitis	47	17.3
Peritonitis	37	13.6
Salmonella-positive	27	9.9
Dehiscence/acute hernia	25	9.2
Systemic inflammatory response syndrome/endotoxaemia	21	7.7
Pleuropneumonia	19	7.0
Colitis	10	3.7
Haemorrhage (Haemoperitoneum)	9	3.3
Myopathy	9	3.3
Abortion	8	2.9
Inappetence/anorexia	6	2.2
Neuropathy	6	2.2
Hyperlipidaemia	5	1.8
Anaemia, mild	4	1.5
Melena	4	1.5
Respiratory distress	4	1.5
Tachycardia	4	1.5
Disseminated intravascular coagulation	4	1.5
Rectal tear	3	1.1
Hyperazotaemia	3	1.1
Intestinal impaction	3	1.1
Gastric ulceration	2	0.7
Multiple organ dysfunction syndrome	2	0.7
Kidney failure	2	0.7
Sinus tachycardia	2	0.7
Cardiac/liver failure	1	0.4
Clostridium infection	1	0.4
Enteritis	1	0.4
Haematoma in body wall	1	0.4
Haemorrhage from enterotomy/anastomosis	1	0.4
Hypocalcaemia	1	0.4
Hypoproteinaemia	1	0.4
Keratitis	1	0.4
Diaphragmatic flutter	1	0.4
Premature ventricular contraction	1	0.4
Radial nerve paralysis	1	0.4

(Continues)

**TABLE 1** (Continued)

Complication	No. of papers	% of papers
Skin reaction at injection site	1	0.4
Thrombocytopenia	1	0.4
Weight loss	1	0.4
Anaemia requiring transfusion	1	0.4

**TABLE 2** Reported complications occurring during hospitalisation that led to relaparotomy after colic surgery in equids.

Complication	No. of papers	% of papers
Postoperative colic	21	7.7
Recurrence of problem	19	7.0
Problem with anastomosis	19	7.0
Adhesions	19	7.0
Postoperative reflux	14	5.1
Problem with not resected intestine	12	4.4
Postoperative colic and reflux	12	4.4
Wound dehiscence	9	3.3
Peritonitis	9	3.3
Haemoperitoneum	6	2.2
Intestinal dislocation	6	2.2
Haemorrhage from enterotomy or anastomosis	1	0.4

before discharge, leading to relaparotomy, leading to euthanasia during the first hospitalisation and after discharge from the hospital. Follow-up was categorised as short- or long-term according to the time reported in each article. If not specifically reported, short-term follow-up was defined as the time of discharge from the hospital, while long-term follow-up was defined as the time after discharge from the hospital. No additional methodological quality or risk of bias assessment was performed, according to the scoping review protocol.<sup>16</sup> For each article, the following data were also collected: whether the term complication was explicitly defined in the study, whether the definition for each complication was provided and whether the complications were graded by severity and classified by time frame. Further, the time period of the occurrence of complications was analysed and categorised as 'short-term' or 'long-term'. The definitions used in the studies for each period were also summarised. Summary statistics were calculated, and data were reported as medians (range). The evidence was presented in narrative form and in tables and charts.

### 3 | RESULTS

#### 3.1 | Selection of sources of evidence

A total of 8923 studies were identified in the initial database search. Figure 1 highlights the flow of publication search and assessment, as

**TABLE 3** Reported complications occurring during hospitalisation that led to euthanasia or death after colic surgery in equids.

Complication	No. of papers	% of papers
Peritonitis/intestinal rupture/leaking from anastomosis or enterotomy	53	19.5
Systemic inflammatory response syndrome/endotoxaemia	34	12.5
Postoperative colic	30	11.0
Postoperative reflux	27	9.9
Adhesions	25	9.2
Colitis/enteritis	14	5.1
Postoperative colic and reflux	11	4.0
Wound dehiscence	11	4.0
Signs of nonviable intestine	10	3.7
Laminitis	10	3.7
Recurrence of problem	10	3.7
Trauma	9	3.3
Haemoperitoneum/haemorrhagic shock	7	2.6
Myositis/myopathy	7	2.6
Collapse/cardiovascular compromise	7	2.6
Neurological problems	7	2.6
Problem with anastomosis	6	2.2
Pneumonia	5	1.8
Declining clinical condition/ lack of improvement	4	1.5
Intestinal impaction	4	1.5
Mesenteric haematoma/haemorrhage	3	1.1
Haemorrhage from anastomosis/enterotomy	2	0.7
Hyperlipaemia	2	0.7
Liver failure	2	0.7
Kidney failure	2	0.7
Shock	2	0.7
Neoplasia	2	0.7
Septicaemia	1	0.4
Pulmonary oedema	1	0.4
Grass sickness	1	0.4
Suppurative pancreatitis	1	0.4
Respiratory distress	1	0.4
Fungal pneumonia	1	0.4
Salmonellosis	1	0.4
Haemorrhagic purpura	1	0.4
Vaginal haemorrhage	1	0.4
Disseminated intravascular coagulation	1	0.4
Retroperitoneal abscess	1	0.4

**TABLE 4** Reported complications occurring after discharge or within the follow-up period after colic surgery in equids.

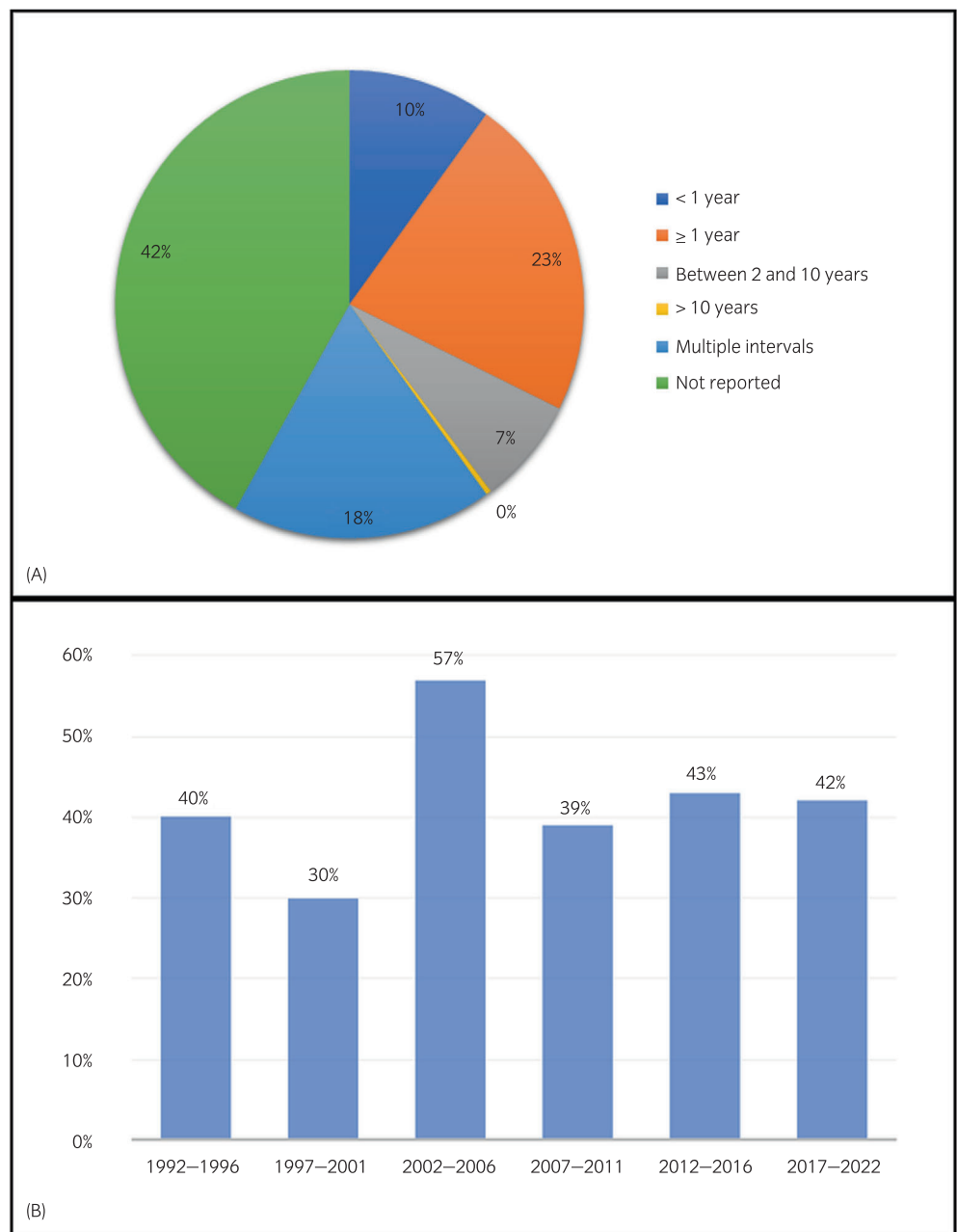
Complication	No. of papers	% of papers
Postoperative colic	78	28.7
Hernia	47	17.3
Incisional infection	25	9.2
Laminitis	14	5.1
Adhesions	13	4.8
Weight loss	11	4.0
Other/trauma	7	2.6
Diarrhoea	5	1.8
Peritonitis	4	1.5
Wound dehiscence, complete	3	1.1
Wound dehiscence, partial	3	1.1
Thrombophlebitis	2	0.7
Problem with anastomosis	1	0.4
Progression of neoplasia	1	0.4
Colitis	1	0.4
Paraphimosis	1	0.4
Abortion	1	0.4
Inappetence	1	0.4
Pyrexia	1	0.4

outlined in the selection of evidence sources. Among 5850 articles potentially eligible for the review, after screening, 353 underwent full-text assessment; of these, 272 met the final inclusion criteria and were charted (Table S1).

### 3.2 | Characteristics of the sources of evidence

The most frequent types of study design were retrospective cohort studies (121/272) and retrospective case series (82/272), followed by prospective observational studies (29/272), prospective clinical trials (25/272), retrospective case-controlled studies (12/272) and prospective case series (4/272). The range of study types was wide (Figure S1A) and the numbers of different publication types of the studies varied throughout the time interval (Figure S1B). Most of the studies were conducted in North America and Europe (Figure 2A), with a median sample size of 53 animals (range 3–896, Figure S2), leading to a total of 26 242 equids. Seventy-nine of 272 (29%) studies reported diseases of the small intestine, 65 of 272 (24%) of the large intestine and 128 of 272 (47%) reported both. A ventral midline laparotomy approach was described in 265 (97.4%) studies, while ventral paramedian or flank laparotomy was described in seven (2.6%) studies. Seventy-two studies (26.4%) focused on single complications, including 35 on surgical site infection (SSI); 13 on postoperative reflux (POR); three each on adhesions, postoperative

**FIGURE 3** (A) Overall percentages of studies reporting each time interval for long-term follow-up. (B) Percentage of articles for each 5-year period that did not report long-term follow-up in the past 30 years



colic (POC), or salmonellosis; two each on abortion, diarrhoea, disseminated intravascular coagulation, haemorrhage, or thrombophlebitis; and one each on arrhythmia, dehiscence, hyperlipaemia, laminitis and neurological problems. Twenty-nine studies focused on a single population (six on foals; four each on geriatric or miniature horses; three on pregnant mares; two on Thoroughbreds, Thoroughbred mares, horses younger than 2 years; one article each on stallions only or post-parturient mares only, Andalusian, draught, endurance horses, or race-horses). One hundred and two articles focused on one pathology, whereas 37 focused on a specific surgical technique. Large colon volvulus was the most reported pathology (11 studies), followed by caecal impaction and epiploic foramen entrapment (seven studies each). The complete data charting of all the sources is reported in Table S1.

### 3.3 | Results of individual sources of evidence

No study explicitly defined the term complication. Complications were characterised according to the severity in one study, which described them as ‘major’ or ‘minor’; however, the criteria by which complications were judged were reported only for the ‘major’ category.<sup>17</sup> One study graded complications as ‘medical’ and ‘nutritional’ but was focused on postoperative feeding practice.<sup>18</sup> None of the studies cited a classification of complications from either human or veterinary surgery. One study reported the definitions of ‘sequela’, ‘progression’ or ‘recurrence’ of lesions, but not that of complications.<sup>19</sup> Two articles reported ‘adverse events’ without defining them, thus using the term synonymously for ‘complications’.<sup>20,21</sup>

A total of 81 different complications were reported (Table S2). The most common complications were POC (157/272, 57.7%), POR (130/272, 47.7%), incisional complications (including SSI:120/272, 44.1%), peritonitis (83/272, 30.5%), SSI only (80/272, 29.4%), diarrhoea (79/272, 29%), laminitis (61/272, 22.4%), thrombophlebitis (53/272, 19.4%), adhesions (52/272, 19.1%), pyrexia (51/272, 18.7%), systemic inflammatory response syndrome (SIRS) or endotoxaemia (48/272, 17.6%), salmonellosis (27/272, 9.9%), dehiscence/acute hernia (25/272, 9.1%), pleuropneumonia (19/272, 6.9%) and colitis (10/272, 4.4%). The most reported complications varied according to the region where the study was conducted (Figure 2B).

Multiple definitions of these complications were reported. Twenty different definitions were provided for POR/POI in 62 articles, 20 for SSI in 38 articles, 18 for incisional complications in 29 articles, 13 for diarrhoea in 19 articles, 13 for thrombophlebitis in 14 articles, 13 for pyrexia in 22 articles, nine for SIRS/endotoxaemia and dehiscence/acute abdominal hernia in 10 articles, seven for laminitis in nine articles, six for POC in 14 articles, six for peritonitis in nine articles, three for salmonellosis in six articles, three for pleuropneumonia/pneumonia in three articles, and two for inappetence/anorexia in two articles. One definition was provided for colitis and haemorrhage/haemoperitoneum. While other complications were reported, no studies provided definitions. The details of the definitions reported for each complication are listed in Tables S3–S18.

A pattern of reporting complications was found in several articles and the overall review. Four frames were identified: complications occurring and resolved medically during the hospitalisation period (Table 1), complications leading to relaparotomy during or shortly after hospitalisation (Table 2), complications leading to postoperative euthanasia during hospitalisation (Table 3) and complications occurring in the long-term postoperative period (either medically resolved, leading to euthanasia, or leading to a second surgery) (Table 4).

The short-term follow-up was not clearly defined in 101 of the 272 articles. Most of the remaining studies (163/272 articles) considered short-term follow-up as the time between surgery and hospital discharge. The short-term follow-up period was defined as a time interval of <1 month after surgery in 5/272 articles and 1–2 months after surgery in 3/272 articles. The long-term follow-up periods in which complications were reported were highly variable. Among 158 articles, the time interval was defined as <1 year after surgery in 27 studies, ≥1 year in 61 studies, 2–10 years in 20 studies and >10 years in one study. Multiple long-term intervals were reported by 49 studies (<1 month to >10 years) (Figure 3A). Long-term follow-up was not reported in the remaining 114 of 272 articles. The percentages of articles that did not report long-term follow-up varied over the last 30 years (Figure 3B).

## 4 | DISCUSSION

### 4.1 | Summary of the evidence

This scoping review identified pertinent and current literature available on postoperative complications after colic surgery between 1992

and 2022. Within this body of literature, the key identified issues included a paucity of studies reporting the definitions of complications and a lack of homogeneity in the criteria used to define each complication. Thus, comparisons of these studies are very difficult or even impossible.

### 4.2 | Reporting of complications

A relatively high number of postoperative complications have been reported in equine colic surgery. Many studies have reported only a few or single complications. Although focusing on a single complication, particularly in prospective studies comparing two interventions, may be appropriate, this makes it impossible to define the true morbidity of a procedure or pathology or the success of a treatment or procedure.<sup>3,4</sup>

### 4.3 | Definitions of complications

The definitions of complications varied widely among studies, even if they focused on the same complication. For some complications, no clear definition has been reported; in contrast, a plethora of definitions can be found in the literature for other complications. Standardised criteria to categorise and define complications are important to judge the consequences of a specific treatment to make risk-weighted choices and clearly communicate with owners and referring vets. Establishing an agreement regarding the inclusion criteria is a common issue in research settings. A clear classification with standard criteria can help surgeons to obtain a complete picture of the risks and complications associated with a specific procedure. Incomplete classifications and broad definitions can lead veterinarians and owners to misleading conclusions regarding the safety of a specific procedure. Each surgical decision should be calibrated based on the risk-benefit ratio and adapted to the type of problem to be treated. The lack of homogeneous and consistent definitions makes it difficult to interpret data on complication rates, with risks of underestimating or overestimating the safety of a specific treatment. The use of standard definitions for complications would allow the inclusive representation of morbidity after colic surgery to compare and objectively assess the outcomes of each surgical procedure, reduce biases and allow better communication with owners.

### 4.4 | Classification of complications

Classification systems that provide standard definitions and grading criteria have been proposed in both human and veterinary medicine.<sup>3–6,8–13</sup> Despite the usefulness of these guidelines, analysis of studies in the literature has revealed limited knowledge or lack of their application in studies on postoperative complications after equine colic surgeries. This review also identified a limited differentiation



between complications, causes of complications, sequelae, failure to cure and technical errors. While Clavien and Dindo<sup>3,5</sup> proposed definitions for these terms, they have not been considered in studies on surgical colic in equids. Freeman attempted to distinguish complications from events that could cause complications in the development of POR.<sup>22</sup> POR is a complication that can be caused by various functional (postoperative ileus) and mechanical (adhesions, anastomotic impaction, recurrence of intestinal dislocation) events.<sup>22,23</sup> It is important to differentiate these events for proper assessment and treatment. The results of this review highlighted the paucity of studies reporting standard definitions of complications and a lack of reference to previously proposed defining and grading systems. The results of these studies are often contradictory, and comparison among them is extremely difficult.

#### 4.5 | Follow-up

While the reporting of postoperative complications occurring during hospitalisation is important, reporting the long-term complications is crucial for assessing the success of a procedure since many complications may occur after discharge or have long-term consequences. Approximately 40% of the studies screened in this review did not report long-term follow-up. The rates of complications reported after discharge and the time frames for 'long-term' follow-up differed, with a wide range in follow-up durations between studies. Furthermore, the percentage of studies reporting long-term complications did not increase over the last 30 years. More accurately defining and stating the duration of follow-up and implementing standardised timeframes will help to clarify the interpretation of outcome measurements. Short-term follow-up showed fewer differences in definition, with most studies considering it as the period between surgery and discharge from the hospital. Although reporting outcomes at discharge from the hospital is certainly a good measure of the success of a procedure, reporting only short-term complications or considering only a short period after discharge could underestimate morbidity, limiting the possibility of providing a complete picture of the consequences of a procedure.

#### 4.6 | Limitations

The scoping review process has several limitations. Broad inclusion criteria were used to identify as many appropriate studies as possible in key veterinary research databases including PubMed, CAB, Web of Science and Scopus, which were outlined in the a priori protocol; however, this search strategy could not capture some studies that would have met the inclusion criteria, both due to selection bias and lack of access to the full texts. In addition, full texts not in English were not considered; thus, there was a risk of excluding important data. Limitations in the data reported in some articles and potential errors in their evaluation during data abstraction were also possible.

We considered only postoperative complications without considering events occurring during surgery or recovery from anaesthesia, which may account for perioperative complications. Studies on intraoperative complications may provide a different picture of the morbidity associated with colic surgeries.

We chose the time interval 1992–2022 because the first classifications of complications in human surgery were published in 1992.<sup>3</sup> Thus, we aimed to evaluate whether the tools from human surgery had been applied by researchers in the equine colic field. However, other time intervals may have led to the different results.

## 5 | CONCLUSIONS AND FUTURE RECOMMENDATIONS

The reporting, defining and grading of complications in the field of equine colic surgeries is lacking. Moreover, confusion exists regarding distinguishing complications from other adverse events that may be associated with technical errors, failure to cure, sequelae, or causing of complications rather than complications themselves. Furthermore, the definitions of each complication vary, making it impossible to compare studies.

The adoption of standardised definitions and grading schemes could improve communication with owners. This standardisation could also help surgeons to have a complete picture of the morbidity of a specific procedure and, therefore, improve their performance. Finally, it would allow researchers to report complications in a more complete and representative manner, which would also allow greater comparability between studies. A proposed classification system and univocal definitions of each complication are needed in equine colic surgery to improve the evidence from studies. Proposals regarding complications occurring before discharge should first be validated in clinical cases to match their definitions and/or grouping with the effective impact (e.g., in terms of hospitalisation, outcome, or cost) of complications on the outcome of the procedure. Surveys of owners and veterinarians should be conducted to reach a consensus on the seriousness of complications in the post-discharge period. Finally, recommendations of an expert consensus on the criteria for homogeneous complication reporting and grading, developed by an independent and multidisciplinary panel of experts using rigorous Delphi methodology, should be produced.<sup>24</sup>

#### AUTHOR CONTRIBUTIONS

All authors contributed to study design and methodology. Marco Gandini and Anna Cerullo carried out the database searches and exclusion, with consultation of Gessica Giusto if required. Data extraction and interpretation was performed by all authors. All authors contributed to manuscript preparation and critical review. Marco Gandini is responsible for data integrity.

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## CONFLICT OF INTEREST

No competing interests have been declared.

## PEER REVIEW

The peer review history for this article is available at <https://publons.com/publon/10.1111/evj.13881>.

## DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study. The protocol was registered at the OSF Registries and can be downloaded at the following link: [https://osf.io/c3e2j/?view\\_only=93fc59fe7649447daaac35a1eb364500](https://osf.io/c3e2j/?view_only=93fc59fe7649447daaac35a1eb364500).

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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