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Multidisciplinary perioperative management of emergency laparoscopic appendectomy for perforated appendicitis in a child with Duchenne muscular dystrophy: a case report

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Case Report

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Abstract

Background: Children with Duchenne muscular dystrophy (DMD) are vulnerable to anesthesia-associated rhabdomyolysis-like events, hyperkalemia, postoperative respiratory failure, and occult cardiomyopathy. These risks complicate emergency abdominal surgery, where delayed source control may worsen sepsis. Detailed pediatric perioperative reports describing multidisciplinary risk mitigation for emergency abdominal surgery in DMD remain extremely limited, and practical clinical pathways are lacking.

Case presentation: A 9-year-old Han Chinese ambulatory boy with genetically confirmed DMD (exon 51 deletion) presented with 40 hours of right lower quadrant pain, peritoneal irritation, a fecalith on ultrasound, markedly elevated inflammatory markers (C-reactive protein 186.84 mg/L), and elevated creatine kinase (5139 U/L). Focused preoperative cardiopulmonary assessment showed preserved left ventricular systolic function and no biochemical evidence of acute myocardial injury. An urgent multidisciplinary meeting involving pediatric surgery, anesthesiology, pediatric intensive care, neurology, and endocrinology was convened within 6 hours of admission. Hybrid single-incision laparoscopic appendectomy with an additional 5-mm assisting trocar was performed under non-trigger total intravenous anesthesia, with strict avoidance of succinylcholine and volatile anesthetic agents, serial arterial blood gas and potassium monitoring, perioperative steroid bridging, readiness for malignant hyperthermia-like deterioration including immediate availability of dantrolene, and planned postoperative pediatric intensive care unit admission. Intraoperative findings confirmed perforated gangrenous appendicitis with diffuse purulent peritonitis. The patient was extubated shortly after PICU arrival, developed no perioperative hyperkalemia, arrhythmia, pigmenturia, or MH-like hypermetabolic signs, and recovered uneventfully after staged antibiotic therapy.

Conclusions: This case illustrates a practical perioperative pathway for emergency abdominal surgery in a selected ambulatory child with DMD and supports timely minimally invasive source control when perioperative risk mitigation is protocolized. However, it should not be interpreted as a representative model for all patients with Duchenne muscular dystrophy, particularly those with advanced cardiopulmonary impairment or more complex airway and metabolic risk profiles.

Background

Duchenne muscular dystrophy (DMD) is a progressive X-linked dystrophinopathy characterized by ongoing skeletal muscle degeneration and progressive involvement of the respiratory and cardiac systems. In the perioperative setting, patients with DMD are at increased risk for anesthesia-associated rhabdomyolysis-like events, hyperkalemia, postoperative respiratory insufficiency, difficult ventilatory weaning, arrhythmia, and occult cardiomyopathy, making emergency surgery especially challenging [1–3]. Importantly, these perioperative metabolic crises may clinically mimic malignant hyperthermia (MH), although DMD is not generally regarded as a classic MH-susceptible disorder. Therefore, the anesthetic priority is strict avoidance of triggering agents and early recognition of hyperkalemic or rhabdomyolysis-

related deterioration rather than assuming conventional MH susceptibility. In addition, chronic corticosteroid exposure, reduced cough efficiency, impaired mobility, and limited physiologic reserve may further complicate perioperative decision-making.

Accordingly, emergency surgical management in DMD requires more than routine preoperative clearance. Special management approaches usually include rapid cardiopulmonary risk stratification, avoidance of succinylcholine and volatile anesthetic agents, preference for non-trigger total intravenous anesthesia when feasible, perioperative steroid replacement in chronically treated patients, serial monitoring of potassium and acid–base status, continuous end-tidal carbon dioxide and temperature monitoring, preparation for rescue treatment of hyperkalemia and rhabdomyolysis-like events, confirmation of institutional readiness for MH-like hypermetabolic deterioration including immediate availability of emergency drugs such as dantrolene, and planned postoperative ventilatory and intensive care support when indicated [1–4]. Transition and emergency planning have therefore been emphasized as an important, but often underdeveloped, component of DMD care [4].

Acute appendicitis is common in childhood, but detailed perioperative reports involving children with DMD remain extremely limited. Published dystrophinopathy-associated appendicitis reports have mainly involved adults, difficult airway rescue scenarios, or perioperative cardiac concerns rather than pediatric cases with clearly described perioperative risk stratification, metabolic surveillance, and postoperative critical care bridging [5, 6]. In addition, acute abdominal pathology in DMD may be harder to recognize because abdominal signs can be attenuated by muscle weakness and inflammatory manifestations may be modified by chronic corticosteroid therapy. Accordingly, the present case should be interpreted as an illustrative example in a selected ambulatory child with relatively preserved cardiopulmonary reserve, rather than a representative model for all children with Duchenne muscular dystrophy. Nevertheless, when perforation or diffuse peritonitis is suspected, delayed source control may worsen abdominal sepsis and increase morbidity [7, 8].

We present this case in accordance with the CARE framework and focus on practical perioperative considerations that may help clinicians manage similar emergencies in carefully selected patients, including DMD-specific risk stratification, diagnostic reasoning in the setting of acute abdomen, non-trigger anesthesia, intensive metabolic surveillance, perioperative steroid replacement, emergency preparedness for MH-like deterioration, and planned pediatric intensive care unit (PICU) bridging.

Case presentation

A 9-year-old Han Chinese boy weighing 47 kg with genetically confirmed DMD (exon 51 deletion; diagnosis established in 2018) presented with 40 hours of right lower quadrant abdominal pain. He remained ambulatory on level ground, had mild right-leg fatigue, and required assistance when climbing stairs. He had no known cardiomyopathy, no long-term non-invasive ventilation requirement, and no history of previous abdominal surgery. He had been receiving long-term oral prednisolone and calcium/vitamin D supplementation. There was no relevant family history beyond the known DMD

diagnosis. From a perioperative standpoint, this baseline profile suggested a relatively early-stage and selected DMD phenotype with preserved functional reserve, which is important when interpreting the generalizability of the present case.

On examination, he had marked right lower quadrant tenderness with rebound tenderness. Ultrasound demonstrated appendicitis with a fecalith and local inflammatory change. Admission laboratory tests showed leukocytosis, a markedly elevated C-reactive protein concentration (186.84 mg/L), elevated creatine kinase (5139 U/L), and a normal serum potassium concentration. Admission arterial blood gas showed no lactic acidosis and no evidence of hyperkalemia. Given the neuromuscular background and chronic corticosteroid exposure, these objective findings were interpreted together with imaging and serial clinical assessment rather than relying solely on potentially blunted abdominal signs or inflammatory manifestations.

Because of the known risks associated with DMD, focused preoperative cardiopulmonary assessment was performed before anesthesia. Echocardiography showed preserved left ventricular systolic function (left ventricular ejection fraction 67%; fractional shortening 36.5%) without major structural abnormality. High-sensitivity troponin I and B-type natriuretic peptide were within the normal range. Electrocardiography showed sinus tachycardia without malignant arrhythmia. The baseline respiratory assessment did not suggest established chronic ventilatory dependence.

A summary timeline of the episode of care is shown in Table 1.

Table 1
CARE-style timeline of the episode of care.

Time	Clinical event	Key findings / management
~ 40 h before admission	Onset of RLQ abdominal pain	Progressive pain, later associated with peritoneal irritation
Day 0, admission	Emergency evaluation	RLQ tenderness with rebound tenderness; ultrasound: appendicitis with fecalith
Day 0, admission labs	Initial laboratory assessment	Leukocytosis, CRP 186.84 mg/L, CK 5139 U/L, potassium normal, no lactic acidosis
Within 6 h of admission	Multidisciplinary consultation	Pediatric surgery, anesthesiology, PICU, neurology, endocrinology
Preoperative period	DMD-specific perioperative assessment	Echo: preserved LV systolic function; hs-TnI/BNP normal; ECG sinus tachycardia; no chronic ventilatory dependence
Day 1	Operative intervention	Hybrid SILA + 1 under non-trigger TIVA; pneumoperitoneum at 10 mmHg
Intraoperative period	Operative findings	Perforated gangrenous appendicitis with diffuse purulent peritonitis; lavage and drain placement
Immediate postop	Critical care bridging	Transfer to PICU intubated; extubated 1.5 h later after stabilization
POD1–POD3	Early recovery	Stable hemodynamics, no arrhythmia, no pigmenturia, no hyperkalemia; inflammatory markers trending down
POD3	Drain removal	Output decreased, abdominal findings improved
POD0–POD7	Anti-infective treatment	Meropenem-based therapy, later de-escalated per clinical improvement
POD12	Discharge	Uneventful recovery; discharged in stable condition

Diagnostic assessment

The patient presented with a typical acute abdominal syndrome characterized by right lower quadrant pain, localized rebound tenderness, inflammatory marker elevation, and ultrasonographic evidence of appendicitis with a fecalith. In combination, these findings strongly supported the diagnosis of acute appendicitis, while the prolonged symptom duration, marked inflammatory response, and peritoneal irritation increased concern for perforated or gangrenous disease.

The main diagnostic reasoning focused on two parallel questions: first, whether urgent source control was required for the abdominal pathology; and second, whether the patient's DMD status substantially altered operative timing, anesthetic planning, or postoperative disposition. The presence of peritoneal

signs, a fecalith, and a high inflammatory burden argued against prolonged non-operative observation and favored urgent operative management.

Diagnostic interpretation in children with DMD may be more difficult than in otherwise healthy children because abdominal guarding can be blunted by muscle weakness, inflammatory manifestations may be modified by chronic corticosteroid exposure, and symptom expression may be less typical in the setting of chronic neuromuscular disease. These considerations further lowered our threshold for integrating imaging findings and objective inflammatory markers into decision-making. Important differential considerations included mesenteric lymphadenitis, gastroenteritis, Meckel's diverticulitis, and nonspecific abdominal pain; however, the focal right lower quadrant tenderness with rebound tenderness, together with the ultrasonographic findings and inflammatory profile, made these alternatives less likely. Intraoperative confirmation of perforated gangrenous appendicitis with diffuse purulent peritonitis validated the preoperative diagnostic reasoning.

The major diagnostic challenge was not establishing the abdominal diagnosis itself, but determining how to safely proceed in the context of DMD-associated perioperative risk. Elevated creatine kinase was interpreted cautiously because baseline CK may already be high in DMD, and therefore serial potassium, acid–base status, electrocardiography, cardiac biomarkers, and focused echocardiography were used to distinguish chronic neuromuscular disease burden from acute anesthesia-relevant metabolic or cardiac instability. Preoperative assessment showed preserved left ventricular systolic function, no biochemical evidence of acute myocardial injury, sinus tachycardia without malignant arrhythmia, and no evidence of chronic ventilatory dependence. These findings supported urgent surgery with enhanced perioperative precautions rather than delay for extensive additional testing.

Therapeutic intervention

Following multidisciplinary discussion, urgent operative source control was selected because the clinical presentation favored complicated appendicitis and delay could reasonably increase septic morbidity. On March 2, 2026, hybrid single-incision laparoscopic appendectomy with an additional 5-mm right lower quadrant assisting trocar (SILA + 1) was performed. Pneumoperitoneum was maintained at 10 mmHg to reduce cardiopulmonary burden while preserving adequate operative exposure.

Intraoperatively, diffuse purulent peritonitis and perforated gangrenous appendicitis near the appendiceal base were identified, confirming complicated appendicitis. Appendectomy and abdominal lavage were completed successfully, and an intra-abdominal drain was placed because of the diffuse contamination.

General anesthesia was delivered using non-trigger total intravenous anesthesia (non-trigger TIVA) with complete avoidance of succinylcholine and volatile anesthetic agents. Because DMD-related anesthesia complications may clinically resemble MH despite being pathophysiologically distinct from classic MH susceptibility, the perioperative strategy emphasized trigger avoidance, continuous temperature and end-

tidal carbon dioxide monitoring, serial arterial blood gas and potassium surveillance, and explicit rescue readiness for hyperkalemia, rhabdomyolysis-like events, arrhythmia, and postoperative respiratory deterioration. Before induction, the anesthesia workstation was prepared for a non-trigger technique, and emergency drugs including dantrolene were made immediately available in case of unexpected MH-like hypermetabolic deterioration. Continuous electrocardiography, temperature monitoring, end-tidal carbon dioxide monitoring, urine-output assessment, and serial arterial blood gas analyses were used throughout the procedure. Potassium remained stable and there was no progressive acidosis. Because the patient had been receiving long-term oral prednisolone, perioperative stress-dose glucocorticoid coverage was administered intravenously.

Follow-up and outcomes

After surgery, the patient was transferred intubated to the PICU for planned postoperative monitoring and ventilatory bridging. He was successfully extubated at 14:30 on the same day, approximately 1.5 hours after PICU arrival, after confirmation of stable hemodynamics, acceptable gas exchange, and no evidence of immediate anesthetic or metabolic deterioration.

Early postoperative surveillance focused on respiratory status, cardiac rhythm, urine output and urine color, potassium, acid–base balance, temperature, and clinical signs of ongoing intra-abdominal sepsis. Hemodynamic status remained stable throughout the postoperative course, and there was no perioperative arrhythmia, pigmenturia, hyperkalemia, progressive acidosis, or need for non-invasive ventilatory rescue. No intraoperative or early postoperative signs suggestive of MH-like deterioration were observed, including rapid unexplained hypercapnia, hyperthermia, generalized rigidity, progressive metabolic acidosis, or sudden hyperkalemia. Key perioperative arterial blood gas and metabolic data are summarized in Table 2.

Table 2
Key perioperative arterial blood gas and metabolic profile.

Time point	pH	K+ (mmol/L)	Lactate (mmol/L)	Comment
Admission	7.43	4.0	1.4	No hyperkalemia or acidosis
After induction	7.39	3.8	1.2	Stable hemodynamics
Intraoperative check	7.36	4.1	1.6	No progressive acidosis
PICU arrival	7.37	4.3	1.7	Suitable for early extubation

Peritoneal cultures grew mixed enteric flora, and postoperative antimicrobial therapy was escalated to meropenem and subsequently de-escalated according to clinical improvement and microbiologic context. Inflammatory markers decreased progressively during hospitalization, and creatine kinase also showed a downward trend after source control. The intra-abdominal drain was removed on postoperative day 3 when drainage decreased and abdominal findings improved. Oral intake was

resumed gradually, bowel function recovered, and no unanticipated adverse event occurred during hospitalization.

The patient recovered without major complication and was discharged in stable condition on postoperative day 12. From the clinician's perspective, the perioperative plan was considered successful because it achieved timely source control without cardiopulmonary or metabolic decompensation. From the family's perspective, early extubation and the absence of major postoperative events were regarded as especially reassuring.

Discussion

This case adds to the limited literature on appendicitis in dystrophinopathy by providing a structured description of pediatric perioperative management for emergency abdominal surgery in DMD. Existing literature emphasizes that patients with DMD are vulnerable to anesthesia-associated rhabdomyolysis-like events, hyperkalemia, sensitivity to neuromuscular blocking agents, postoperative respiratory decompensation, and occult cardiac complications [1–3]. At the same time, published appendicitis-related reports in dystrophinopathy remain sparse and are largely limited to adult cases, difficult airway rescue scenarios, or perioperative cardiac concerns rather than pediatric protocolized perioperative management with explicit risk stratification, metabolic surveillance, and postoperative intensive care planning [5, 6]. A brief comparison of selected published reports with the present case is provided in Table 3.

Table 3
Selected published dystrophinopathy-associated appendicitis reports and comparison with the present case.

Study	Age / setting	Main challenge	Relevance to present case
Brunner et al. [5]	Adult; urgent laparoscopic appendectomy	Anticipated difficult airway and rescue planning	Shows appendicitis-related perioperative risk in dystrophinopathy, but not a pediatric protocolized pathway
Aihara et al. [6]	Retrospective DMD cohort	GI complications in DMD; appendicitis rare	Provides epidemiologic context rather than operative detail
Present case	9-year-old child; perforated appendicitis	Balancing urgent source control with DMD-specific anesthesia and PICU risk	Adds an illustrative pediatric multidisciplinary pathway with objective metabolic monitoring and early extubation in a selected ambulatory child with preserved cardiopulmonary reserve; not representative of all DMD phenotypes

A key contribution of the present report is the practical framing of "special management approaches" for a surgical emergency in a child with DMD.A practical perioperative algorithm summarizing this approach is shown in Fig. 1. In this case, these approaches included rapid multidisciplinary consultation, focused rather than unnecessarily prolonged preoperative cardiopulmonary assessment, clear prioritization of

source control once complicated appendicitis was suspected, non-trigger TIVA with avoidance of succinylcholine and volatile agents, perioperative steroid replacement, serial monitoring of potassium and acid–base status, continuous temperature and end-tidal carbon dioxide monitoring, pre-induction confirmation of emergency readiness including immediate access to dantrolene, and planned PICU bridging after surgery. Together, these measures demonstrate how DMD-specific perioperative concerns can be incorporated into emergency surgical decision-making without automatically defaulting to delay or non-operative management.

The laparoscopic strategy also deserves comment. Complicated appendicitis with diffuse peritonitis may prompt concern that a high-risk neuromuscular patient should undergo a simpler or more conservative operation. In this case, however, preserved cardiopulmonary reserve, low-pressure pneumoperitoneum, and close anesthetic monitoring supported a minimally invasive approach. In children with appendicitis, objective factors such as fecalith, inflammatory burden, and perforation risk remain important when balancing operative versus non-operative strategies [7, 8]. Our case suggests that DMD itself should not automatically preclude urgent minimally invasive source control when perioperative risk mitigation is feasible and baseline cardiopulmonary reserve is acceptable. However, this inference should be applied cautiously and cannot be generalized to children with advanced DMD, established ventilatory dependence, significant cardiomyopathy, or markedly increased airway risk.

An additional practical point is the distinction between true malignant hyperthermia susceptibility and DMD-associated anesthesia-related rhabdomyolysis-like reactions. Although these events may overlap clinically, current guidance suggests that DMD is not a classic MH-susceptible disorder; instead, exposure to succinylcholine or volatile anesthetic agents may precipitate severe hyperkalemia and acute rhabdomyolysis that can resemble MH. For this reason, our perioperative strategy emphasized trigger avoidance, continuous temperature and end-tidal carbon dioxide monitoring, serial metabolic surveillance, and pre-induction confirmation of emergency readiness, including immediate access to dantrolene, rather than framing DMD as conventional MH susceptibility.

The main strengths of this report are the clear perioperative structure, the explicit diagnostic reasoning, and the practical clinical detail. Rather than merely reporting a rare coexistence of DMD and appendicitis, the case describes how abdominal urgency was weighed against neuromuscular perioperative risk, how chronic steroid use affected perioperative endocrine management, how serial metabolic monitoring informed intraoperative safety assessment, and how postoperative PICU observation was used as a bridge to early extubation and ward transfer. These features increase the educational value of the case for clinicians facing similar emergencies in resource-equipped pediatric centers.

This report also has several important limitations. First, it is a single-case observation and therefore cannot support broad conclusions regarding safety, superiority, or standardization of perioperative management in DMD. Second, the patient was ambulatory, had no established cardiomyopathy, no chronic ventilatory dependence, and showed relatively preserved preoperative cardiopulmonary reserve; accordingly, this case represents a selected early-stage phenotype rather than the broader DMD

population. Third, perioperative success in this case depended on rapid multidisciplinary coordination, availability of pediatric anesthesia and PICU resources, and close metabolic monitoring, all of which may not be universally available. Fourth, the favorable perioperative course observed here should not be taken to imply that a similar strategy would be equally feasible or safe in most children with DMD, particularly those with advanced cardiomyopathy, chronic ventilatory dependence, or more limited physiologic reserve. Fifth, although emergency preparedness for MH-like deterioration was part of the perioperative plan, the absence of such an event in this case does not allow any conclusion regarding the comparative effectiveness of different emergency response strategies.

Therefore, this report should be understood as an illustrative case in a selected ambulatory child with relatively preserved cardiopulmonary status, not as a representative model for all patients with Duchenne muscular dystrophy. Even so, it provides practical value by showing that, in carefully selected children with DMD and suspected complicated appendicitis, prompt source control can be combined with DMD-specific perioperative risk mitigation in a structured and clinically usable pathway.

Patient perspective

The patient's guardian stated that the greatest concern before surgery was whether anesthesia would be more dangerous because of Duchenne muscular dystrophy than the abdominal infection itself. After multidisciplinary discussion and step-by-step explanation of the perioperative plan, the family felt reassured by the clear rescue strategy and the close PICU monitoring arrangement. The guardian considered the smooth recovery and early extubation especially important.

Conclusion

In a carefully selected child with Duchenne muscular dystrophy, perforated appendicitis can be managed safely with timely source control when perioperative risks are assessed rapidly and addressed through focused multidisciplinary coordination. The key clinical lesson from this case is not technical novelty, but the importance of avoiding unnecessary delay while optimizing anesthesia, cardiopulmonary monitoring, infection control, steroid support, and postoperative respiratory care.

Abbreviations

BNP
B-type natriuretic peptide
CK
Creatine kinase
CRP
C-reactive protein
DMD
Duchenne muscular dystrophy

ECG
Electrocardiography
hs-TnI
High-sensitivity troponin I
LV
Left ventricular
LVEF
Left ventricular ejection fraction
MH
Malignant hyperthermia
PICU
Pediatric intensive care unit
POD
Postoperative day
RLQ
Right lower quadrant
SILA
Single-incision laparoscopic appendectomy
TIVA
Total intravenous anesthesia

Declarations

Ethics approval and consent to participate

Institutional review board approval was not required for publication of a single de-identified case report in accordance with local policy. Consent to participate was not applicable for this case report.

Consent for publication

Written informed consent was obtained from the patient's legal guardian for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and materials

All data relevant to the case are included in this article. Additional de-identified details may be made available by the corresponding author on reasonable request, subject to institutional and privacy restrictions.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

QZ conceptualized the report, collected and interpreted the clinical data, and drafted the manuscript. ZZ participated in clinical management and critically revised the manuscript. MH contributed to data collection and manuscript revision. GZ participated in clinical management and manuscript revision. All authors read and approved the final manuscript.

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QZ is a pediatric surgeon at the Children's Hospital of Fudan University (Xiamen Branch), Xiamen Children's Hospital, with clinical and research interests in pediatric surgical oncology and perioperative management of pediatric surgical conditions.

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Figures

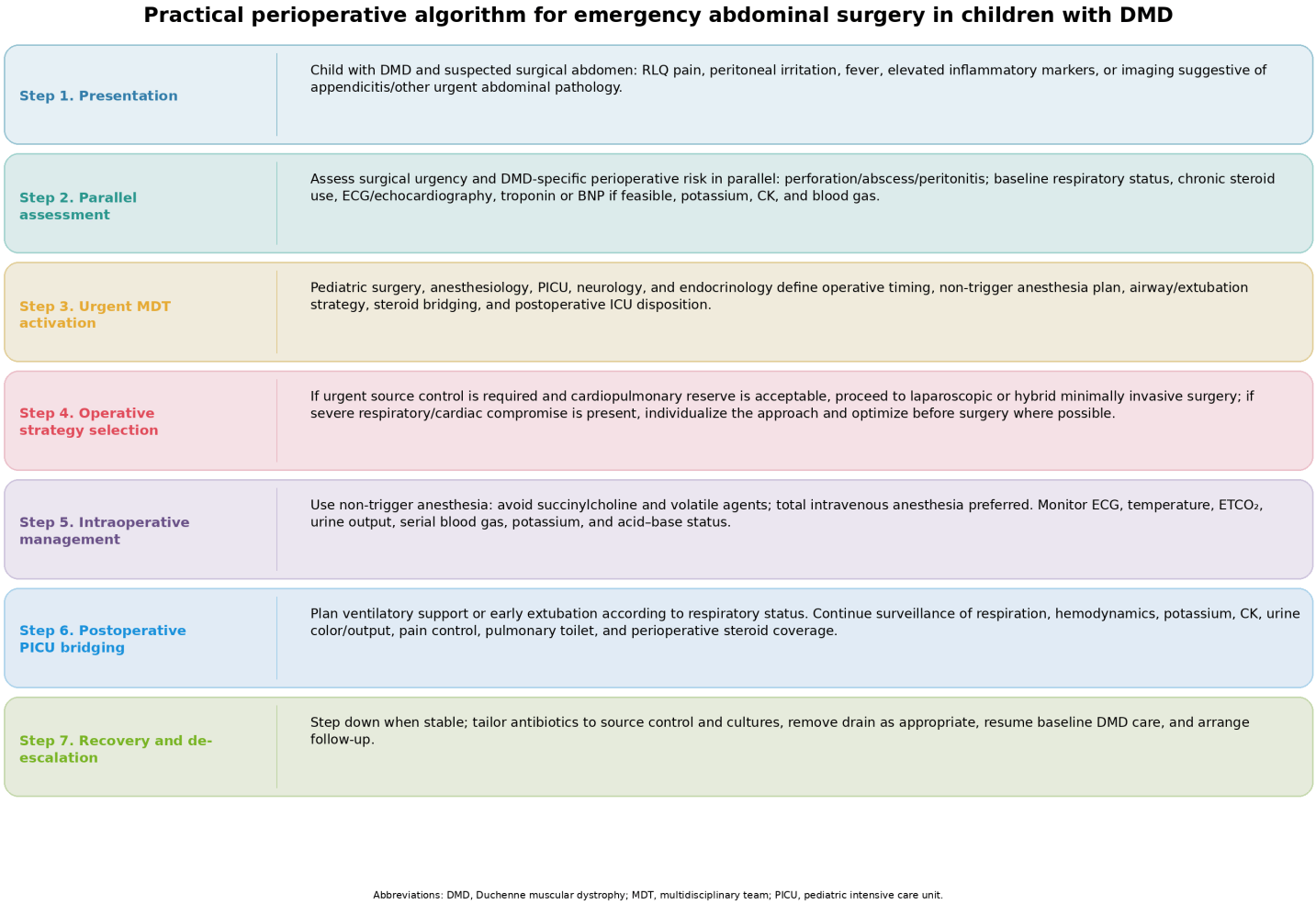


Figure 1

Practical perioperative algorithm for emergency abdominal surgery in children with Duchenne muscular dystrophy (DMD).

The proposed pathway emphasizes early recognition of surgical urgency, focused DMD-specific cardiopulmonary and metabolic assessment, awareness that anesthesia-related deterioration may mimic rather than represent true malignant hyperthermia, strict trigger avoidance, preparedness for hyperkalemia and rhabdomyolysis-like crises including immediate access to emergency drugs such as dantrolene, and planned postoperative PICU bridging in selected patients.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- CAREChecklistDMDAppendicitis.docx