Anesthetic Management of a Patient with Surgically Corrected D-Transposition of the Great Arteries Undergoing Laparoscopic Pyloromyotomy

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Citation


Abstract

We present a case of a newborn with surgically corrected D-transposition of the great arteries (D-TGA) undergoing laparoscopic pyloromyotomy. Anesthetic implications of corrected D-TGA are discussed. As more children with successful repair of D-TGA survive into adulthood, anesthesiologists will increasingly encounter them as patients presenting for noncardiac surgery. It is important to understand the type of repair that was performed as well as the residual comorbidities particular to each procedure. With careful preoperative evaluation and experienced providers, routine anesthetics with noninvasive monitoring can be a safe option.

INTRODUCTION

With the exception of isolated ventricular septal defects, D-transposition of the great arteries (D-TGA) is the most common congenital cardiac defect. As surgical repair has become more successful, long-term survival rates have improved and the need for subsequent noncardiac surgeries for these children has increased in frequency. Few data exist regarding the anesthetic risks faced by patients with surgically corrected D-TGA and only one small case series has attempted to document anesthesia techniques and outcomes in this population. We describe the anesthetic management of an infant with surgically repaired D-TGA undergoing laparoscopic pyloromyotomy.

CASE REPORT

A 7-week-old boy presented for surgical treatment of pyloric stenosis. The patient had presented to the emergency department with a 3-day history of projectile vomiting progressively increasing in frequency. An abdominal ultrasound revealed the diagnosis of pyloric stenosis with a 19 × 6 mm pylorus. The patient had a significant medical history that included an arterial switch operation (ASO) for the treatment of D-transposition of the great arteries (D-TGA), diagnosed prenatally. Shortly after birth prostaglandin therapy was started at a dose of 0.1 μg/kg/min. Soon after initiation of prostaglandin therapy the patient developed apnea requiring intubation and mechanical ventilation. An echocardiogram at that time revealed D-TGA with an intact interventricular septum. The patient also had a restrictive patent foramen ovale and a small patent ductus arteriosus. The patient was therefore taken to the cardiac catheterization laboratory for a balloon atrial septostomy, which was performed without complications. The patient’s oxygen saturation by pulse oximetry (SpO\textsubscript{2}) immediately improved from 70% to 95% by the conclusion of the procedure.

On day 5 of life the patient was taken to the operating department for an arterial switch operation. The operation went smoothly and the patient recovered from the procedure and was discharged home on postoperative day 10. The patient’s medical regimen included digoxin and furosemide.

The patient was brought to the operating department for a laparoscopic pyloromyotomy at 7 weeks of age. Preanesthetic evaluation confirmed that the patient had been rehydrated and that electrolyte balance had been restored. Intravenous atropine was administered (0.16 mg) and the patient’s stomach contents were evacuated with a 14 French suction catheter placed by the oral route. A modified rapid-sequence induction (positive pressure ventilation during induction with cricoid pressure applied) was performed using propofol 3 mg/kg and rocuronium 1 mg/kg intravenously. Maintenance of anesthesia included the use of desflurane and morphine 0.1 mg/kg. The laparoscopic
pyloromyotomy was performed without complications and
insufflation pressure was limited to less than 10 mm Hg.
Neuromuscular blockade was reversed with neostigmine and
glycopyrolate and the patient was extubated and transferred
to the recovery room with 30% inspired oxygen
concentration. The patient was monitored overnight in the
critical care unit and had an uneventful postoperative course.
The patient was discharged on postoperative day 1 after it
was confirmed that he was tolerating full feeds by the oral
route.

DISCUSSION

Patients with D-TGA with intact ventricular septum that has
been surgically corrected by ASO have a long-term survival
rate of 90% to 92%.\(^1\) Supravalvular pulmonary stenosis and
aortic insufficiency are the most common long-term
complications and the majority of cases are classified as
mild to trivial at 10 years. Asymptomatic atrial and
ventricular premature beats can occur but are uncommon.
Because the coronary arteries are reimplanted during repair,
myocardial ischemia is a potential problem following ASO.
Although 90% to 97% of patients have patent coronary
arteries by angiography, 89% of coronary events occur in the
first 3 months following ASO.\(^1\)

Extracardiac defects associated with D-TGA are rare, and
patients in whom this defect has been surgically repaired
who later undergo noncardiac surgery have been managed as
having normal heart structure and function. A recent case
series suggests that the majority of these patients can safely
undergo routine general anesthesia with no invasive
monitoring.\(^2\)

Consistent with current practice, our patient underwent
general anesthesia for laparoscopic pyloromyotomy in the
usual fashion using standard monitors and typical rapid-
sequence induction technique for this procedure. Although
the tachycardia and stress due to pretreatment with atropine
and awake orogastric suctioning increase the patient’s
myocardial oxygen demand, the risk of aspiration was
deemed more significant than the risk of myocardial
ischemia. The rapid-sequence induction was modified in
order to maintain adequate oxygenation during induction.
This technique is commonly used in neonates and was
particularly important in this patient, who had a slightly
increased risk of stress-induced myocardial ischemia. The
standard rapid-sequence induction dose of rocuronium was
modestly reduced because the procedure was expected to be
relatively short.

The overwhelming majority of pyloromytomies in infants
are done laparoscopically. Laparoscopic surgery can alter
cardiopulmonary function due to intra-abdominal pressure,
positioning, and absorbed carbon dioxide. Pulmonary effects
of decreased functional residual capacity, decreased
pulmonary compliance, and ventilation/perfusion mismatch
can lead to hypercapnia and hypoxemia. Pneumoperitoneum
causes increased pulmonary and systemic afterload and
decreases cardiac output. Hypercapnia can initiate a
sympathetic response with increases in heart rate, blood
pressure, and possibly ventricular arrhythmias. Laparoscopic
surgery in children with congenital heart disease (CHD) was
originally considered contraindicated due to these
physiologic challenges. However, recent literature has
suggested that cardiovascular effects are minimal if
insufflation pressures are maintained at less than 10 mm Hg,
and several case reports have described successful
laparoscopic surgery in patients with CHD.\(^3\)

Hypertrophic pyloric stenosis (HPS) is a relatively common
diagnosis in infancy but the cause is unknown. It has been
associated with certain syndromes that can also include
CHD, and one small study suggests an association between
isolated HPS and CHD.\(^4\) Our patient did not have a
congenital syndrome and had no other known
gastrointestinal abnormalities.

Gastric outlet obstructive lesions have also been linked to
HPS and can mimic the clinical and radiological findings.
These include eosinophilic gastroenteritis, transpyloric
feeding tubes, and gastric mucosal hypertrophy. Treatment
with prostaglandins has been shown to induce proliferation
of gastric antral mucosa, occasionally causing gastric outlet
obstruction in infants.\(^5\) It has been postulated that secondary
HPS can develop in response to the obstruction caused by
prostaglandin-induced foveolar hyperplasia.\(^6\) Although our
patient did receive a prostaglandin infusion prior to his D-
TGA repair, he did not have a history of gastric outlet
obstruction during his initial hospitalization.

As more children with successful repair of D-TGA survive
into adulthood, anesthesiologists will increasingly encounter
them as patients presenting for noncardiac surgery. It is
important to understand the type of repair that was
performed as well as the residual comorbidities particular to
each procedure. With careful preoperative evaluation and
experienced providers, routine anesthetics with noninvasive
monitoring can be a safe option for this patient population.
References
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