A Decade of Difficult Airway Response Team

Lessons Learned from a Hospital-Wide Difficult Airway Response Team Program

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KEYWORDS

• Difficult airway response team • Rapid response teams • Difficult airway patient
• Multidisciplinary airway management • Simulation-based medical education
• Hospital difficult airway alert systems • Difficult airway registry • Second victim

KEY POINTS

- Difficult airway adverse events continue to be the fourth most common event in the American Society of Anesthesiologists closed claims database, with devastating consequences to patients, families, providers, and institutions.
- Multidisciplinary airway teams have been shown to reduce emergency surgical airways and the associated morbidity and mortality.
- The Johns Hopkins Hospital Difficult Airway Response Team (DART) program has integrated operations, safety, and educational components designed to improve multidisciplinary teamwork and communications, reduce airway-related adverse events, and promote innovative educational activities for airway providers.
- Institutions interested in initiating a DART program can use the Johns Hopkins program as a roadmap for developing a similar initiative.

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INTRODUCTION

Difficult airway adverse events continue to be the fourth most common type of adverse event in the American Society of Anesthesiologists (ASA) closed claims database, with devastating consequences to patients, families, providers, and institutions.[1] Patients with difficult airways present unique challenges in emergency situations, particularly outside the operating room, increasing the risk of life-threatening complications, including anoxic brain injury, death, and long-term disability. In the ASA closed claims analysis, respiratory-related events were twice as likely in remote locations than in the operating room (OR).[2] Litigation related to these events may result in significant settlement costs, including structured settlements for those patients with permanent neurologic disability, often resulting from anoxic brain injury. Although the events are likely underreported and national data on prevalence are not currently collected, the state of Maryland lists airway events resulting in death and disability as the sixth most common reported adverse event, after falls, pressure ulcers, surgical events, delays in treatment, and medication errors, but the second highest fatality rate of all events.[3]

A decade ago (2008-2018) the Johns Hopkins Hospital Difficult Airway Response Team (DART) program was created as a multidisciplinary effort to prevent airway-related morbidity and mortality after evaluating a series of actual or near miss events related to emergency difficult airway management between 2005 and 2007. Root cause analysis indicated that a major factor in airway event morbidity and mortality was the lack of a systematic approach for responding to difficult airway patients in an emergency. Common themes across these adverse events were inconsistent paging/communication, lack of availability of advanced and specialized airway equipment, insufficient training/experience of providers for advanced and specialized procedures, lack of a mechanism for reliably enlisting more experienced physicians, and unclear definition of roles and responsibilities during a multidisciplinary airway event. In addition, the authors made the following observations:

- All events occurred outside the OR environment.
- Four primary disciplines were involved anesthesiology and critical care medicine (ACCM), otolaryngology–head and neck surgery (OHNS), trauma surgery (TS), and emergency medicine (EM)
- Although each discipline had recognized difficult airway experts—at national and international levels—the authors had not effectively leveraged their expertise to form a coordinated, multidisciplinary approach to complex airway management at the institution.

A business plan was drafted to fund the startup and operational costs of what would become the DART program. An oversight committee was formed to lead the DART program, which included physician representation from ACCM, OHNS, TS, and EM as well as risk managers, safety officers, human factors engineers, and Lean Six Sigma experts.

DIFFICULT AIRWAY RESPONSE TEAM PROGRAM: GOALS AND DESIGN

The DART program had 5 goals:

1. Establish a coordinated, multidisciplinary emergency response process for managing adult difficult airway patients.
2. Decrease the risk of adverse airway events resulting in permanent disability or death.

3. Minimize institutional liability related to adverse airway events.
4. Improve provider communication and education.
5. Disseminate information about difficult airway management to patients and other providers.

The structure of the DART program was built around 3 pillars, and new processes were developed within each:

1. Operations and quality improvement. The focus was on simplification of activating multiple specialty DART providers by using the emergency paging system's "universal" phone number that activates code and emergency rapid response teams. Code team activations could be escalated to DART if requested by any bedside provider during a patient event. DART activation results in attending physicians from ACCM, OHNS, and TS coming to the bedside within 10 minutes or less. Based on review of DART activations, standardized DART carts were developed and strategically placed throughout the institution to facilitate delivery of specialty equipment to the bedside when a DART call is activated. Respiratory therapists are trained to assist with the DART cart setup and use. On arrival to the bedside, a brief DART time-out is performed to ensure agreement on the airway management plan and roles. Every DART event is entered into a confidential internal airway registry for subsequent review by the DART oversight committee. Equipment specialists process all DART carts within 3 hours, and units are notified of the locations of backup DART carts in the event of another DART activation. See **Fig. 1** for an example of a DART cart. Patients are provided with educational materials to ensure future continuity of care.
2. Safety. In the first year of the DART program's existence, in situ simulations of difficult airway events were conducted in 5 different hospital units with high-fidelity simulators to evaluate and mitigate system defects. A multitude of defects were identified that resulted in systems improvements, including improved method of team paging and activation, elevator key placement on all DART carts, refinement

Fig. 1. DART cart. This photograph shows the organization of a standard DART cart.

of DART cart supplies (eg, safety scalpels instead of nonretractable scalpels and scope hanging case), assignment of DART parking space at the emergency room entrance, and development of a DART cart inventory and safety checklist. Quarterly multidisciplinary DART case review conferences were also held for continuous learning and process improvement.

3. Education. A DART program multidisciplinary difficult airway course was developed by DART practitioners and presented quarterly for senior house staff and airway support staff to standardize training across departments and teach advanced airway management techniques through lectures and simulations. Web-based DART education learning modules were also created for all staff members. Policies and procedures were created and then updated and approved by the medical board every 3 years. Multidisciplinary institutional grand rounds for DART are held biannually. Joint faculty appointments were initiated for DART faculty departmental leaders to foster multidisciplinary teamwork, communications, training, and academic advancement.

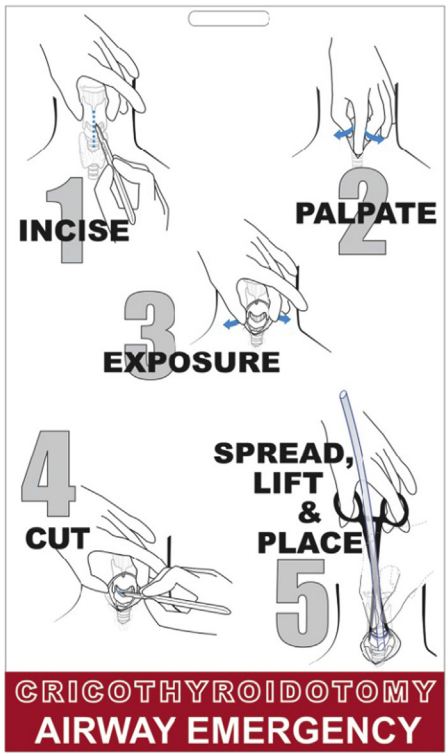
DIFFICULT AIRWAY RESPONSE TEAM PROGRAM: RESULTS

In 2015, the authors published a comprehensive article on the DART program that provided an overview of DART program implementation, analysis of DART airway event data, inventory lists for DART carts, cost considerations for DART operations, in situ simulation results, and a DART program implementation package to assist other institutions in developing a DART program.[4]

Between 2008 and 2013, there were 4738 code activations that were escalated to a DART 360 times (7.5%); 29 (8%) of these required emergency surgical airways, and 62 (17.2%) of patients were stabilized and transported to the OR for definitive airway management in a controlled environment. Risk factors for DART activation included body mass index greater than 30, history of difficult airway, history of head and neck tumor, history of chronic obstructive pulmonary disease, history of tracheostomy, current tracheostomy, limited cervical spine range of motion, airway edema (nonallergic), angioedema, and active airway bleeding (**Box 1**). Direct laryngoscopy, fiberoptic bronchoscopy, and videolaryngoscopy (VL) were the most frequent techniques used. The use of rigid laryngoscopy by OHNS reduced the need for surgical airways in many cases, improving patient outcomes. Standardization of emergent surgical cricothyroidotomy techniques resulted in no adverse patient complications when performed. See **Fig. 2** for the program's 5-step approach.

Box 1
Risk factors for Difficult Airway Response Team patients

- Body mass index >30
- History of difficult airway
- History of head and neck tumor
- History of cervical spine injury
- History of angioedema
- Current tracheotomy
- History of chronic obstructive pulmonary disease
- Current airway bleeding
- Previous tracheotomy



CALL 5-4444

Tell Operator:
1. "I need the difficult airway response team!"
2. Building Name, Floor, Room #, Unit Phone #

AIRWAY CART LOCATIONS:

Area	Location	Phone
ED	Trauma Bay (G1332)	5–2280
NCCU	3005B Alcove	5–8070
ZBOR	Next to Room 315	5–8075
PICU	Across from Room 19	5–5260
CVSICU	Across from Room 15	5–4826
L & D	Outside OR 1	5–5850
SICU	Across from Room 53	5–5370
MICU	10180A Alcove	5–5570
Wbg OR	Room 3333	2–1223
WICU	Nurse Manager Office	2–1048
Wbg 5	Between B & C (5261)	5–8880
JHOC	PACU (Room LL055)	5–4006
MPCU	Main Nurses Station	5–5340
Hal 2	Alcove H268	7–3127

WHO WILL ARRIVE:

ACCM Attending/Senior Resident
Trauma Attending & Senior Resident
OLHN Attending (in house 7a–5p and on-call 5p–7a)
OLHN Senior Resident (in house)
Respiratory Therapy

Fig. 2. DART airway emergency card. An example of a laminated card all DART providers receive detailing the steps for performing an emergency cricothyroidotomy and for DART activation and DART cart locations.

During this time, 18 DART multidisciplinary difficult airway courses were taught, resulting in the training of more than 200 providers; 20 ACCM grand rounds problem-based learning DART cases were presented; and 5 institutional DART program multidisciplinary grand rounds were presented.

Overall, there were no airway-related deaths, sentinel events, or malpractice claims for adult patients managed by DART during this first 5-year period. At the 10-year mark, the DART program continues to sustain these results—there have been no airway-related deaths, sentinel events, or malpractice claims for adult patients.

LESSONS LEARNED

1. Clarify attending roles when you arrive at the bedside: "Who's in charge?"

   When a DART is activated and members arrive at the patient bedside, there is an immediate briefing and formulation of an airway plan, backup plans, optimal location (bedside, unit, or OR) and responsibilities of each individual. Once a primary plan is agreed on, attending physicians work together to optimize patient care.

   The authors clarified attending roles to prevent confusion or disagreement at an actual event:

   - ACCM attending: pharmacology, physiology, mask ventilation, noninvasive airway techniques (eg, mask airway, supraglottic devices, VL, fiberoptic

intubation and bronchoscopy, and emergent surgical cricothyroidotomy in the event that an airway needs to be immediately established prior to the arrival of OHNS, TS, or EM attending present)
- OHNS attending: noninvasive airway techniques (eg, fiberoptic intubation and bronchoscopy, rigid laryngoscopy, and bronchoscopy) and emergent surgical cricothyroidotomy[5]
- TS attending: noninvasive airway techniques (bronchoscopy) and emergent surgical cricothyroidotomy
- EM attending: pharmacology, physiology, mask ventilation, noninvasive airway techniques and emergent surgical cricothyroidotomy

2. Agree on a standardized approach for airway management for all specialties.

   To avoid disagreements between different disciplines regarding preferred algorithms or guidelines for airway management, it is important that a standardized approach for airway management be agreed on by all involved DART program specialties. For example, ACCM members adhere to the ASA guidelines (**Fig. 3**),[6] but the other specialties have their own professional practice standards, with preferred alternative approaches. Collaboration to optimize utilization of the different specialty approaches enhances care and treatment of patients.

   To address this, the authors combined the ASA difficult airway guidelines with the Vortex approach, introduced by Chrimes (**Fig. 4**).[7,8] The Vortex approach facilitates graphic visualization of the progression from noninvasive airway techniques, such as face mask ventilation, placement of supraglottic airway (SGA), or endotracheal tube, advising no more than 3 attempts per each—to a standardized surgical technique if noninvasive techniques are unsuccessful. Incorporation of the Vortex approach into operations, safety, and educational programs has resulted in a more comprehensive understanding and consistent application of airway management decisions at DART events by all DART providers.

3. Maintain fiberoptic intubation and bronchoscopy skills, because they remain the gold standard for awake intubation and select asleep airway management scenarios.

   Despite emerging airway technologies that have replaced many instances in which awake fiberoptic intubation was the airway technique of choice in some instances, patients presenting with complex physiology and pathology may benefit from awake techniques. In the program's institution, awake fiberoptic intubation remains the technique of choice in cases of angioedema, select head and neck pathology (eg, major resections with abnormal pathology and/or very limited mouth opening, sublingual tumors), patients who have had failed supraglottic device mask ventilation, and select cases of significant morbid obesity (**Box 2**, Case 1).

4. Remember that a surgical airway is not a failed airway and might be the optimal choice.

   Pre-DART review of emergency airway events indicated that a proactive, standardized, awake/open tracheostomy or urgent/emergency cricothyroidotomy, performed by attending physicians in OHNS and TS (or with direct supervision of senior house staff), can be the primary airway management technique of choice for select DART events. A laminated airway emergency card was created that all DART providers received (see **Fig. 2**). Standardization of emergency surgical airway techniques resulted in no adverse patient complications when performed. In the first 5 years of DART, 6 surgical

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DIFFICULT AIRWAY ALGORITHM

1. **Assess the likelihood and clinical impact of basic management problems:**
   - **Difficulty with patient cooperation or consent**
   - **Difficult mask ventilation**
   - **Difficult supraglottic airway placement**
   - **Difficult laryngoscopy**
   - **Difficult intubation**
   - **Difficult surgical airway access**
2. **Actively pursue opportunities to deliver supplemental oxygen throughout the process of difficult airway management.**
3. **Consider the relative merits and feasibility of basic management choices:**
   - **Awake intubation *vs.* intubation after induction of general anesthesia**
   - **Non-invasive technique *vs.* invasive techniques for the initial approach to intubation**
   - **Video-assisted laryngoscopy as an initial approach to intubation**
   - **Preservation *vs.* ablation of spontaneous ventilation**
4. **Develop primary and alternative strategies:**

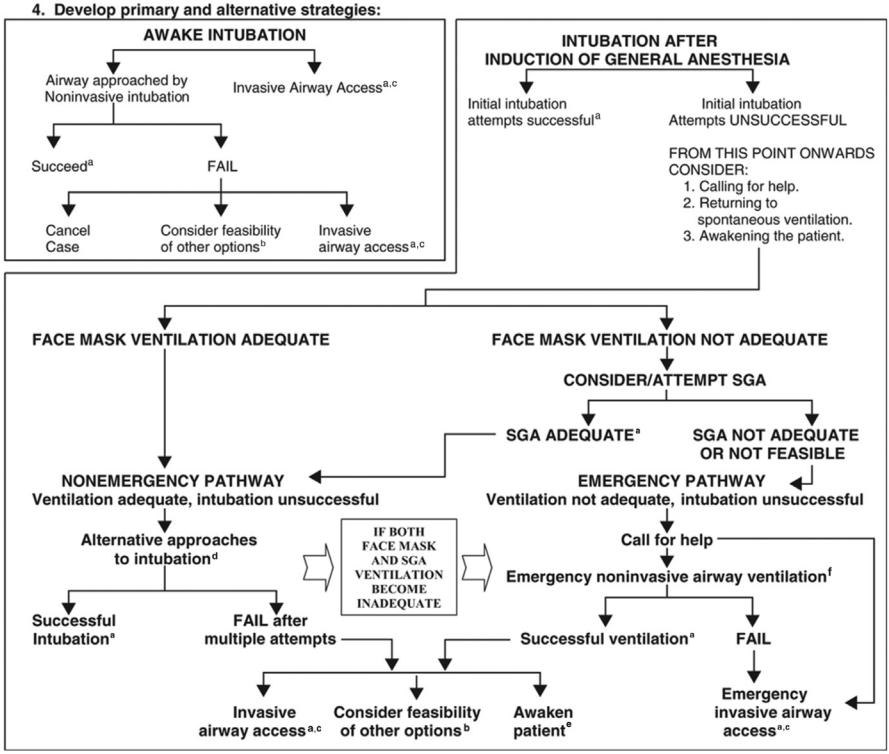

Fig. 3. ASA difficult airway algorithm, 2013. [a] Confirm ventilation, tracheal intubation, or SGA placement with exhaled CO_2. [b] Other options include (but are not limited to) surgery using face mask or SGA anesthesia (eg, LMA, ILMA, and laryngeal tube), local anesthesia infiltration, or regional nerve blockade. Pursuit of these options usually implies that mask ventilation will not be problematic. Therefore, these options may be of limited value if this step in the algorithm has been reached via the emergency pathway. [c] Invasive airway access includes surgical or percutaneous airway, jet ventilation, and retrograde intubation. [d] Alternative difficult intubation approaches include (but are not limited to) video-assisted laryngoscopy, alternative laryngoscope blades, SGA (eg, LMA or ILMA) as an intubation conduit (with or without fiberoptic guidance), fiberoptic intubation, intubating stylet or tube changer, light want, and blind oral or nasal intubation. [e] Consider repreparation of the patient for awake intubation or canceling surgery. [f] Emergency noninvasive airway ventilation consists of an SGA. (*From* Apfelbaum JL, Hagberg CA, Caplan RA, et al. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 2013;118(2):251–70; with permission.)

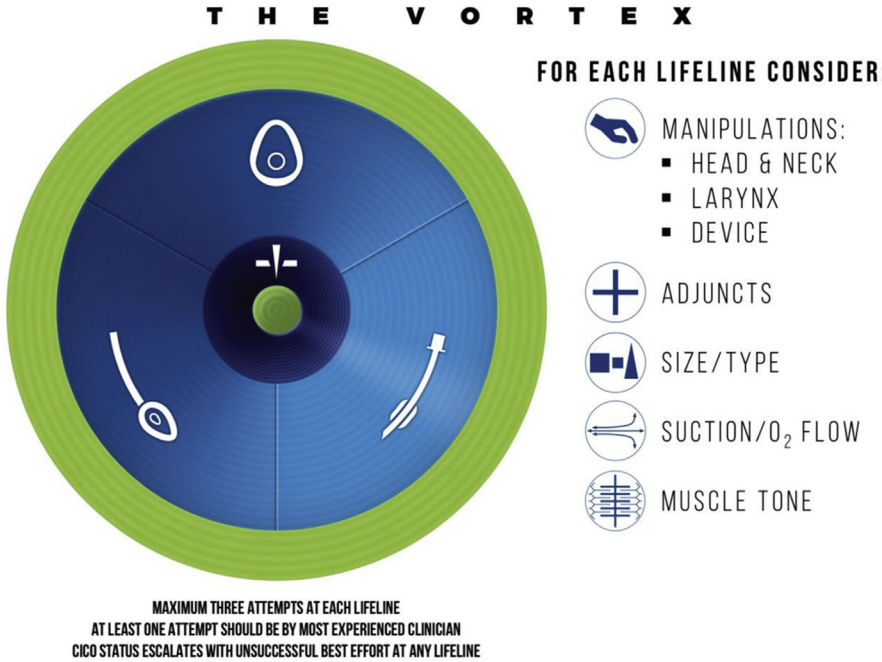

Fig. 4. The Vortex approach to airway management. (*Courtesy of* Nicholas Chrimes; with permission.)

airways were averaged per year without morbidity or mortality. Preliminary review of data from DART years 6 to 10 demonstrates a similar experience (see **Box 2**, Case 2).

5. Keep pace with advances in airway management innovations.

For process improvement of the quarterly DART program airway course, 2 airway management innovations were identified that have since been incorporated into the curriculum: ORSIM bronchoscopy simulator (Airway Simulation Limited, Auckland, New Zealand)[9,10] and Difficult Airway Algorithm and Rescue Cricothyrotomy (DAARC) Web-based program.[11]

The ORSIM can simulate oral and nasopharyngeal, laryngeal, tracheal, and bronchial pathology to simulate difficult upper and lower airway problems. Physically the model consists of a replica flexible bronchoscope, a digital sensor, and a computer. The bronchoscope is inserted into the digital sensor and the computer creates virtual scenarios, visible on the screen that replicates a real-world bronchoscope monitor.

DAARC was created to standardize the Veterans Health Administration team approach to non-OR airways and reduce adverse outcomes from surgical airways. The DAARC educational systems consist of video didactics, podcasts, and an innovative training program that relies on serious gaming in place of traditional live simulation for complex and dynamic clinical decision making. Simulation outcomes include the use of the cognitive aid (Vortex), time to obtain a successful airway, number of attempts in each technique, number of attempts with an optimization of each technique, time interval from failure of nonsurgical interventions until cricothyrotomy, and time from recognition of need surgical rescue to front of neck access.

Box 2
Difficult Airway Response Team case examples

Case 1: A 50-year-old woman presented to an emergency department with angiotensin-converting enzyme inhibitor–induced angioedema, with onset over the past 3 hours to 4 hours. On physical examination, she had significant lip and tongue edema and a reported change in phonation. She had no stridor or respiratory distress and arterial oxygen saturation (Sao_2) was 98% on room air. A DART was activated. OHNS performed a nasopharyngoscopy and noted supraglottic edema (Chiu category classification type 3).[25] The patient was transferred to the OR for airway management. In the OR, in a sitting position, she was nasally topicalized by ACCM while OHNS prepped and topicalized her neck, including a transtracheal lidocaine. A nasal trumpet with endotracheal adaptor was inserted into her right nares to provide supplemental oxygen and verify ventilation while an endotracheal tube was inserted into her left nares for the fiberoptic bronchoscope. There was significant supraglottic and glottic swelling and the intubation was challenging. Tracheal intubation was verified with continuous waveform capnography and the patient was sedated and transferred to the medical ICU for further care.

Case 2: A 49-year-old male patient, postoperative day 2 from a large ventral hernia repair was extubated without incident. Several hours later, he experienced respiratory distress, and the decision was made to reintubate him. ACCM was called and reviewed the OR record, which identified airway management with easy mask ventilation and intubation with VL with an angulated blade. The patient was induced with propofol and rocuronium and noted to be a difficult mask airway. VL with an angulated blade failed to reveal the glottic opening and a supraglottic device was attempted without success. A DART was activated. A nasal and oral airway were placed with evidence of some ventilation and maintenance of Sao_2 88% to 90%. On arrival, OHNS and TS attending physicians worked together and quickly established an emergency cricothyroidotomy, with their standardized technique and a vertical skin incision. The patient had no neurologic complications or adverse complications from the surgical airway and was successfully decannulated a few days later.

Case 3: A 65-year-old patient, body mass index of 60, presented to the emergency department with hypoxic, hypercapnic respiratory failure. He was transferred to the MICU for management and became increasingly obtunded, not responding to continuous positive airway pressure. ACCM was called for urgent intubation. On examination, he was a Mallampati grade 4 with large tongue, full beard, and unknown intubation history. A DART was activated. He was ramped and preoxygenated for 10 minutes with both nasal cannula 15 L and bag-valve-mask with the ZOLL R series continuous waveform capnography. With Sao_2 98%, the patient was induced with propofol and succinylcholine. Laryngoscopy with the McGrath X blade failed to visualize the glottic opening secondary to extensive redundant tissue. The OHNS attending visualized the glottic opening with the Holinger rigid laryngoscopy, advanced an Eschmann stylet and subglottic endotracheal tube successfully, and verified placement with continuous waveform capnography and bilateral breath sounds. Sao_2 was maintained between 98% and 96% for the entire procedure.

6. Collect and use data to continually improve.

   Every DART event is reviewed by the DART oversight team for quality of care delivered including successful and unsuccessful airway management techniques. Examples of items removed from the DART cart because of issues with emergency use include percutaneous cricothyroidotomy kits, jet ventilation, and nonsafety scalpels. Likewise, VL was successful when used in the OR but had less success with DART use at the bedside. Although VL is not a technique currently on the DART cart, many ICUs acquired them, making VL readily available at DART activations. The authors identified, however, that the institution had 3 different VL brands and that not all ICUs had purchased the angulated/difficult airway blade. This was rectified and VL has become a highly successful DART technique.

Another process improvement includes a change in practice to ensure verification of oxygenation and ventilation during DART events. To minimize hypoxia during airway manipulation and ensure effective ventilation, continuous waveform capnography is used during all of aspects of airway management, including mask ventilation, verification of endotracheal intubation/successful surgical airway, and immediate post–airway management and transport. The authors initiated an institutional best practices standard of providing high-flow nasal oxygenation at 15 L/min via nasal cannula, in addition to bag-valve-mask preoxygenation, during airway management and are currently exploring other oxygenation techniques that can deliver up to 30 L per minute nasally during airway management.[12,13] The program's institution upgraded automated external defibrillators to the ZOLL R series (ZOLL, Chelmsford, MA),[14] which facilitates continuous waveform capnography, and initiated best practices, such that all aspects of airway management are verified by continuous waveform capnography—the same gold standard used for all patients receiving any form of anesthetic/airway management in the program's ORs, surgical ICUs, and remote locations[15] (see **Box 2**, Case 3).

As the institution expanded, the authors worked with human factors engineers and safety officers to expand the number of DART carts and mapped out coverage for each ward or ICU to ensure a 10-minute delivery metric. The DART cart locations are displayed on the back of the cricothyroidotomy airway emergence badge (see **Fig. 2**) given to DART team members, with a more comprehensive list/backup DART cart chart available in each patient care area.

7. Create a pediatric DART program

When the DART program was initiated in 2008, there were numerous discussions regarding emergency difficult airway management care for pediatric patients and the establishment of a pediatric DART (pDART) program. The decision was made to develop an adult DART program that would provide coverage to all pediatric patients—specifically to assist in initial assessment and stabilization while pediatric specialists could be mobilized.

From 2008 to 2015, the DART program was activated for 30 pediatric patients, with 90% of these in non-OR locations; 50% of these patients were stabilized by DART and transferred to an OR for definitive airway management by pediatric specialists. Primary successful airway techniques were direct laryngoscopy (30%), OHNS laryngoscope (23%), fiberoptic bronchoscope (14%), VL (12%), and SGA (2%); 7 (12%) surgical airways were performed.

Despite best efforts by the adult DART program and pediatric specialists, the authors realized that the pediatric population had unique challenges, prompting a re-evaluation of creation of a separate pDART program. A formal pDART program business plan was submitted to the institution and was funded. The pDART program emulates the adult DART program's 3 core components and additionally customizes difficult airway management to pediatric patients with a comprehensive consultation service focusing on preventative measures to ensure an airway management plan is in place, particularly for children with craniofacial anomalies.

8. Do not forget the second victim: the aftermath of adverse airway events for providers.

The aftermath of adverse airway events can lead to many victims: the first victims are the patient and family/friends, the second victim is the health care provider involved in the event, and the third victim is the institution at large.[16,17] During

the program's pre-DART event review, many practitioners were emotionally traumatized. The authors built into the DART program extensive support initiatives that included 24-hour review by an oversight team with direct communication to DART members, referrals to a faculty staff and assistance program, peer-to-peer support, and multidisciplinary grand rounds with supportive discussions. In 2011, the institution formalized the Resilience in Stressful Events Team (RISE) program[18] and collaborated with the DART program to include more physicians/airway experts in the RISE program, attend rise peer responder basic and advanced seminars, and participate in the Maryland Patient Safety Center resilience training seminar.[19] Institutions interested in addressing second victims are encouraged to access additional comprehensive materials available on the Web.[20–23] See **Box 3** for a summary of lessons learned.

DISCUSSION

Institutions considering developing a rapid response team focused on difficult airway management can learn from the experience of the Johns Hopkins Hospital DART program. The decision to implement a full DART program, similar in scope to what is described in this article, likely depends on existing expertise for airway management, human and financial resources, and the unique patient populations served by the institution in question. To help facilitate the dissemination of the DART program, the authors have developed an implementation package that includes numerous tools, templates of policies and procedures, and other resources to assist interested institutions.[4]

In 2015, the University of Rochester Medical Center (URMC) adapted and implemented the Johns Hopkins Hospital DART Program at the URMC Strong Memorial Hospital, demonstrating the feasibility of adaptation.[24] This initiative was sponsored by MCIC Vermont, a medical malpractice insurance company, through the Risk Reduction Awards Program.

The Johns Hopkins Hospital DART program oversight committee reviewed the URMC-MCIC proposal and provided guidance in adapting the Johns Hopkins Hospital DART program to align with the unique issues and resources at URMC. The URMC principal investigator participated in a Johns Hopkins on-site review of the DART program and had access to DART tool box resources (**Table 1**), with ongoing monthly consultation. URMC implemented the DART program within 3 months and is currently

Box 3
Lessons learned from the Difficult Airway Response Team program

1. Clarify attending roles when you arrive at the bedside: "Who's in charge?"
2. Agree on a standardized approach for airway management for all specialties.
3. Maintain fiberoptic intubation and bronchoscopy skills, because they remain the gold standard for awake intubation and select asleep airway management scenario.
4. Remember that a surgical airway is not a failed airway and might be the optimal choice.
5. Keep pace with advances in airway management innovations.
6. Collect and use data to continually improve.
7. Create a pDART program.
8. Do not forget the second victim: the aftermath of adverse airway events for providers.

Table 1
Johns Hopkins Hospital interdisciplinary clinical practice manual for patient care: Difficult Airway Response Team adult policy

Keywords: airway, airway cart, airway equipment, D.A.R.T., DART, difficult airway, emergency.

in their third year of practice, with reported 49 successful DART activations. The URMC experience demonstrates that the DART program can be implemented at other institutions with fidelity to the original design.

In conclusion, implementation of the Johns Hopkins Hospital DART program has led to improved patient outcomes, standardized and advanced airway management curricula, fostering multidisciplinary teamwork, and decreased institutional liability.

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