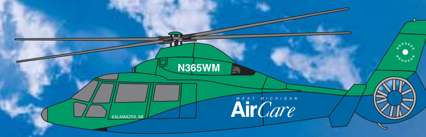
AirWaves



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A Note From the Editor

As you can see, Air Care has made some big changes to its Air Waves. We will be including more photos from around our region. There will also be educational and Aviation/Safety related articles. The list goes on. I would personally like to thank all of you out there for your service, and your loyalty to Air Care. Please, each and every one of you, if there is something you would like to see added to our Air Waves; just let me know. I am certainly interested in providing you with information that will help you personally as well as all EMS providers. I am also interested in starting a section for questions and answers. Send all questions and/ or suggestions to lkriley@aircare.org and include the subject as Air Waves.

In This Issue …

Thank You Borgess Lee Memorial Hospital

Dowagiac, Michigan

West Michigan Air Care would like to take this opportunity to thank Ed Bachman, Maintenance Supervisor for Borgess Lee Memorial Hospital in Dowagiac, and all involved with the making of the new helipad, for their time and energy devoted to completing this project.

Air Care is grateful to you for your perseverance in bringing this project to fruition. It was a long arduous task, but the final outcome is a tribute to your dedication to safety.

Safety is the highest priority in the transport of critically ill/injured patients. The Dowagiac helipad is an excellent example of how a community can strive to maintain safety and excellence in patient transportation. Air Care thanks you sincerely.

Air Care would like to acknowledge your efforts and look forward to utilizing the helipad in cooperation with Borgess Lee Memorial Hospital.

Current Research in Medication Assisted Intubation at Air Care, Part III

– Kevin Franklin; RN, EMT-P

Welcome to the third article in our four part series on Medication Assisted Intubation (MAI). In this article we will briefly review pre-induction medications. Then we will discuss the available options for providing sedation and amnesia for those patients undergoing MAI. In our next and last article on MAI we will discuss neuromuscular blocking agents used to facilite laryngoscopy and control patient movement during and after endotracheal intubation.

Previously we described the need for preoxygenation in order to provide nitrogen washout and minimize hypoxia during the period of apnea during MAI. Next atropine was discussed as an agent to prevent bradycardia associated with laryngscopy and succinylcholine administration. In addition we discussed the use of lidocaine to decrease potential intracranial pressure spikes and as a cough suppressant. We concluded with a discussion on the use of fentanyl to blunt the hemodynamic response of laryngoscopy and intubation as well as provide analgesia to the patient.

Pilot Mark Brynick assisting flight nurses Kevin Franklin and Jan Eichel at Coldwater E.R.

With the patient appropriately pre-medicated for the procedure it is time to bring the patient into a moderate to deeply sedated state that is beneficial during endotracheal intubation. The current formularies list a number of medications that can achieve loss of consciousness and provide amnesia to the patient. The medications that are utilized by Air Care include the benzodiazepine midazolam, the anesthetic induction agent etomidate and the dissociative agent ketamine.

To begin, the benzodiazepines offer an excellent choice for inducing an unconscious state and amnesia. Benzodiazepines work by modulating the action of the intrinsic $GABA^A$ receptor (recall that GABA is the main inhibitory neurotransmitter found in the CNS) [Lehne, 2001]. This modulation leads to an increased Cl^- channel conductance resulting in hyperpolarization of the cell. Once hyperpolarization is reached the cell is no longer able to generate an action potential which leads to the desired traits of sedation, anxiolysis, anticonvulsant, skeletal muscle relaxation and anterograde amnesia (Stoelting, 1999). In addition, since benzodiazepines only modulate the $GABA^A$ receptor, effects are limited to the supply of endogenous GABA present.

Currently Midazolam is the preferred benzodiazepine due to its short onset of action of ~ 1 minute and its short distribution t ½ of 7-10 minutes. At a dosage of 0.025-0.1mg/kg IVP the patient loses conscious thought quickly while minimizing the side effects associated with benzodiazepine use. Side effects commonly encountered include transient apnea which occurs in ~ 2% of patients (Lehne, 2001), decreases in blood pressure occurring secondary to decreases in peripheral vascular resistance (Stoelting, 1999), and a potential inhibition of platelet aggregation noted by Scheu et al. in 2002 (Stoelting, 2006).

For these reasons Air Care has established that Midazolam is a potential medication for use in normal to hypertensive patients only. Patients whom cannot tolerate a drop in blood pressure benefit more from another induction agent, Etomidate.

Etomidate is a non-barbiturate induction agent that has a similar effect of enhancing the $GABA^A$ receptor in the CNS as did the benzodiazepines. Etomidate though has an increased specificity for the *B*2 and *B*3 subunit receptor types for $GABA^A$. These subtypes account for ~ 50% of the receptor subtypes in the CNS and relate to the strong neuro-inhibition that occurs with Etomidate (Reynolds et el., 2003). This results in a more directed suppression of consciousness with a decrease in the deleterious side effects seen with benzodiazepines in clinically compromised patients.

Etomidate's onset of action is similar at 30 – 60 seconds with peak cerebral concentrations seen in 60 seconds (Donnelly, 2005). Duration of etomidate lasts from 3-8 minutes and rapidly decreases due to a large volume of distribution (Brunton, 2006) and redistribution into non-reactive, non-CNS tissue until degradation occurs.

Side effects associated with Etomidate include decreases in the cerebral oxygen metabolic rate and decreases in the cerebral vessels leading to decreases in ICP. In addition a slight decrease in the MAP of up to 15% may occur (< 1% of patients) that is usually not significant unless the patient is already hypotensive (Stoelting, 1999)(Donnelly, 2005). Substantial drops in blood pressure have been noted previously when concurrent use of opioids occurs as well as 1 record of a brief and self resolving second degree type 2 heart block (Vinson, 2002). Generally speaking the decrease in Vt that occurs is augmented by an increase in respiratory rates by patients to maintain a normal minute volume (T_m). Myoclonus occurs frequently, ~ 10% of the time, as does GI discomfort, pain at the injection site and hiccups (Donnelly, 2005).

The most significant side effect for Etomidate is the adrenocortical suppression that occurs even with a single dose. This adrenocortical suppression occurs due to an inhibition of *11-B-hydroxylase* which is a necessary enzyme in the conversion of cholesterol to cortisol [Donnelly, 2005][Fellows, 1983]. Suppression lasts for 4-8 hours with a single dose and may extend to 24 hours or greater in the elderly or previously debilitated patients. Patients whom cannot tolerate this suppression may be treated post-intubation with steroids or have an alternative induction agent used.

Dosing of Etomidate for induction is between 0.2 – 0.4mg/kg IVP [Donnelly, 2005]. Air Care has established that 0.3mg/kg is an excellent dosage to assure loss of consciousness in patients while minimizing negative side effects for most patients. In hypotensive patients the dosage is decreased to 0.2mg/kg IVP in order to minimize the loss of blood pressure ensued while assuring excellent sedation and amnesia.

The last induction agent utilized in the Air Care protocol for MAI is Ketamine as a dissociative agent. This agent can be utilized on patients whom have RAD or a predicted difficult airway as an alternative to Etomidate.

Ketamine works with a variety of receptors in the CNS to alter each receptors physiologic outcome leading to the desired properties of dissociation. Ketamine's receptors include the *N-methyl-D-aspartate (NMDA)*, opioid, monoaminergic, muscarinic and voltage-sensitive calcium channel receptors. The *NMDA* receptor is normally reactive to the excitatory amino acids (EAA) which have their highest concentrations in the CNS, spinal cord, cerebellum, thalamus, basal ganglia, limbic system and cortex. Blockage at these activation sites lead to electrophysiological dissociation between the limbic and thalamoneocortical systems [Dollery, 1991]. The effect is a cataleptic state in which the patient maintains reflexes but is not able to process noxious stimuli.

Flight nurses Bob Mayberry and Kevin Franklin at Watervliet E.R.

Ketamine also has a positive effect on the cardiovascular system by blocking the reuptake of neurotransmitters. This action results in an increased adrenergic response which causes an increase in heart rate and blood pressure as well as bronchodilation [Dollery, 1991]. This last effect makes Ketamine a preferred agent in patients whom have RAD or a predicted difficult airway.

Common side effects seen with Ketamine administration include emergence delirium, hypoventilation, increased cerebral blood flow, tracheobronchial and salivary secretions, nausea/vomiting (common), enhancement of non-depolarizing NMB's, and skeletal muscle tone increases [Dollery, 1991, Stoelting, 1999].

Current dosage recommendations for Ketamine in the literature range from 1 – 2mg/kg for sedation/anesthesia. At Air Care the recommended dosage for sedation is 1.5mg/kg IVP which provides adequate sedation for the patient while minimizing side effects. It should be noted that some prior studies have shown excellent sedation with minimal side effects with dosages as high as 4 mg/kg [Donnelly, 2005].

That concludes the current recommendations for utilizing sedative/hypnotics for induction in MAI. In our final issue we will discuss the use of neuromuscular blocking agents to facilitate laryngscopy in MAI. In conclusion we will overview all of the steps in MAI in order to achieve the best possible intubation conditions.

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The Critical Link Between You and Air Care

Air Care's Communication Center

The West Michigan Air Care (Air Care) Communication Center in manned 24 hours a day, 7 days a week to assist with the transport and care of critically ill and injured patients. We assist our requesters in acquiring a CAMTS accredited Air Medical helicopter when Air Care is unable to respond to transport the patient due to being on another patient flight request, maintenance, or weather. Sometimes Air Care is unable to respond due to weather, but another service may be able due to their weather.

The Air Care Communication Center is manned with well trained personnel with backgrounds from EMT's to Medics, Police and Fire services, Military, and Air Traffic Control.

The Air Care Communication Center is equipped with the latest GPS on screen Flight Following system so we can follow our aircraft from lift off to landing. Location of scene requests can be acquired by gaining an address or street intersections to plot GPS coordinates. Air Care has a mapping system as well as a Yoman System to plot the location coordinates, and then pass this information to the pilot, which will in turn enter the coordinates into the GPS for direct navigation to the scene.

Air Care Communications also serve as the communication point for Kalamazoo County Medical Control, and the Fifth District Medical Control.

Air Care Communication Center gathers needed patient information for the Medical Crew, location of the patient, and receiving hospital and physician. We coordinate with sending hospitals to make sure the patient has everything needed for transport to reduce the ground times, and with the receiving hospital to make sure they are expecting the patient and ready.

An Introduction to Each of Air Care's Communication Specialists

STEVE has been an Air Medical Communications Specialist for 23 years. He started with Borgess Inflight Medical Service at the conception of the program. Steve provided Air Care with a vast amount of experience and knowledge when the Borgess Inflight and Bronson CareFlight merged into our Air Care. Steve has been an EMT for thirty plus years, during which he worked at Kellogg Ambulance in Kalamazoo. Steve also worked as a Tech at Borgess Medical Center Emergency Department.

Steve served in the United States Marine Corps… Thank you for your service!!

Steve spends his time off with his wife, seven children, and five grandchildren. Whew…what a guy! Steve enjoys playing music, working on his five acre yard and taking vacations to new places. Steve also has spent the last couple years doing a major makeover of his home.

TERRY has been working at Air Care since its inception. Terry came to Air Care with extensive experience from two previous communications jobs and other work experience. Terry also has a military background with the U.S. Marine Corps…Thank you for your service Terry! He has also been an EMT for over twenty years. Terry has a Bachelors of Business Administration, with a major in accounting.

Terry leads a very busy life with a full time job at Air Care and another part time job as well. The part time job helps Terry to offset the cost of raising his children. Terry likes to spend his time with his wife and children when he is not busy at one of his jobs. He enjoys working at Air Care and we are so glad to have him on our team. Terry is a huge sports fan and really loves to watch sporting events. He also finds time to coach his kids in various sports.

BETH began her career in EMS 20 years ago with the Three Rivers Fire Department. Beth then worked with Taylor Ambulance Service serving the Metro Detroit area. While working for Taylor Ambulance Service, Beth covered such events as BLS (Basic Life Support) and ALS (Advanced Life Support). Beth was also able to cover many special events such as Red Wing Hockey games, Freedom Festival Fireworks and the Hydroplane Boat races. After three years on the road with Taylor Ambulance Service Beth decided to change the direction of her career and started working in the dispatch center, helping to handle the 200 incoming emergency calls per day. Beth continued there for two more years.

As Beth worked her way to the west, she started working for the Battle Creek Lifecare Ambulance Service. Five years later, Beth and her husband welcomed their son into their lives. Thinking working closer to home was the way to go, she then went to work at Bronson Vicksburg Hospital as a PCA (Patient Care Associate), continuing her migration to the west.

For the last seven years Air Care has been honored with Beth's expertise and experience in the industry. She enjoys spending time with her family and friends. Hopefully Beth will not be desiring to move anymore westward.

MIKE started in EMS in 1985, where he worked for the South Haven Fire Department in South Haven, IN. In 1986 Mike attended EMT school at Gary Methodist Campus in Gary, IN. Mike then furthered his education by attending the Paramedic School at South Suburban College in Hazel Crest, IL. From 1987 to 1993 Mike worked for Daley's Ambulance Service in Chicago, IL. He then joined the Aero Med team in Grand Rapids, dispatching an EMS helicopter. Mike worked for Aero Med for nine years during which he also continued to further his education. Mike now has two College Degrees, one in Information Tech and the other in Business Communications. It was with great pleasure that we brought Mike aboard to join our Air Care family in 2002.

Mike served in the active duty Marine Corps for six years, and also served with the Active Army Reserve for eight years….Thank you for your service Mike!!

Mike has a thirteen year old son Christopher. Mike also works on his fathers farm when he is not out with his son or working here at Air Care.

Heliport/Helistop Safety Precautions

Aircraft Pre-arrival

» NIGHT: Assure adequate perimeter lighting

» Stretcher available - 50' away from landing area, no loose articles, no pillows, blankets, or mattress pad

» Clear vehicles, obstacles and debris within 100 feet of the landing area

» Barricade avenues of approach to landing area with gates, ropes, etc. and use blocking vehicles or additional staff if necessary

» Have O_2 ready, on cart, full and with an operational flowmeter

» Assure staff is present at helipad equipped with eye/ear protection and positioned to view entire area

Aircraft Arrival

» Stretcher is braked or held secure

» Wear appropriate hearing and eye protection

» Monitor helipad for the appearance of any hazards and maintain helipad security

» Wave off helicopter if security is compromised or a hazard exists

» Keep ALL PERSONNEL at least 100 feet from an operating aircraft

» Staff must remain at least 50 feet from the aircraft until the rotors have stopped

» APPROACH ONLY WHEN ROTORS ARE COMPLETELY STOPPED

» When signaled, approach primary loading door of the aircraft FROM THE FRONT

» If control of the stretcher is a concern wait for assistance before approaching the aircraft (high winds, cart steering problems, frosted or icy surfaces)

» Wait for the crew to open the loading door

» Follow crew instruction for loading or unloading

Aircraft Departure

» Assure helipad security is present and adequate to address concerns

» Verify barricades approach avenues to landing area remain intact with gates, ropes or blocking vehicles

» Assure that helipad is clear of bystanders, vehicles, obstacles and debris

» Wear appropriate hearing and eye protection

» Monitor helipad for security and the appearance of any hazards

» Wave off helicopter's departure if security is compromised or a hazard exists

General Safety Precautions

» Keep ALL PERSONNEL at least 100 feet from an operating aircraft

» Approach the aircraft from the front only when signaled

» When in doubt please ask questions

» Depart the aircraft only to the front

» Watch for potential problems

» Never hesitate to wave off a landing or a takeoff if safety is a concern

» Be mindfully aware of patient care and take universal precautions

» Wear appropriate eye and hearing protection around an operating aircraft

» No loose articles (mattress pads, bedding, hats) within 100 feet when blades are in motion

» Do not raise anything higher than head level within 50 feet (e.g. IV poles)

» No vehicle traffic within 50 feet of aircraft

» No smoking within 50 feet of aircraft

» NEVER approach the aircraft from the rear

» Notify Air Care Communication of any changes or new construction (1-800-922-1234)

YOU MAY BE OUR LAST CHANCE TO PREVENT AN ACCIDENT • THANKS FOR YOUR HELP

New Air Care Associate

Please join us in welcoming our newest Air Care crewmember.

Air Care is pleased to introduce our newest medical crew member, **Nick Wright**. Nick graduated from Ferris State University with his Associate Degree in Applied Science Nursing and finished his BSN in the spring of 2006. He has worked for Spectrum Health Butterworth in the emergency department since the spring of 1998. He obtained his paramedic certification from Great Lakes EMS Academy in Jenison in 2001. During the time from 2000- 2004, he also worked as a clinical instructor and helped teach labs for Davenport Universities EMS program. Nick joined Air Care in November of 2006.

Nick was recently married; he and his wife Amy live in Grand Rapids where she continues to work in the ED at Butterworth Hospital. Their hobbies include hockey, golf, tennis, and traveling.

Nick is commissioned in the United States Army Reserve as a 1st Lt. after serving 12 years as an enlisted soldier.

OUR TEAM, WORKING WITH YOUR TEAM, MAKING A CRITICAL DIFFERENCE.

What Makes a Helicopter Fly? *– Laura Riley, Air Care Pilot*

So you ask; what makes a helicopter fly? A simple question, I wish there was as simple of an answer, but unfortunately, there is not. It could be as simple as the engine(s) provide power, the transmission turns the blades which produce lift, and the controls direct the lift so that the helicopter can fly. I know that for most of you, that explanation is way too vague. Therefore, I will proceed to explain to the best of my ability, what makes the helicopter fly.

There are many makes and models of helicopters, each unique in its own way. So my explanation is going to be general to the helicopter itself, not to a specific helicopter. To a degree the above explanation is true…it just leaves out the real nuts and bolts. So if you're really interested in how the helicopter flies, read on.

We will start from the time the pilot straps into the pilots' seat. Prior to starting the engine(s), a power source is needed. Typically this source is the aircraft battery; sometimes it will be an auxiliary power unit. Next, the pilot will start the engine(s), which like any engine; pretty much consists of a part spraying fuel into a contained compartment, and another part providing a spark to ignite the fuel. The pilot will then bring the engine up to the required operating revolutions per minute (RPM). The direct current (DC) electrical power load is then transferred automatically to the generator(s), leaving the battery to be charged and available in the event of generator(s) failure(s). Connecting the engine to the transmission is a large drive shaft which transfers powers to the transmission. The transmission in turn distributes power to the main rotor, tail rotor and generator(s). Next, I am going to explain what other forces are involved in the flight of the helicopter.

The pilot is strapped in, the rotor blades are turning, what now? Well first a brief explanation of the controls to fly the helicopter. First is the cyclic stick that allows for directional flight, in other words it allows the helicopter to bank left and right or tilt forward and backwards. Next is the collective which simultaneously changes the pitch in all of the main rotor blades and allows the helicopter to go up or down. Lastly the tail rotor pedals counteract torque, and provide directional control of the helicopter by preventing the aircraft fuselage from turning in the opposite direction of the main rotor (torque effect) also known as Newton's third law of motion (for every action there is an equal and opposite reaction). Some helicopters also have a manual throttle control which allows the pilot to set the RPM manually. Whether the RPM is set automatically or manually generally depends on the age and mechanics of the helicopter. The thing to remember about these flight controls is that if one is moved, all the others will also have to be moved to maintain the desired course, airspeed and altitude. This is the challenge in flying a helicopter.

Now it is time to go fly. The pilot will gently pull up on the collective, by doing so increasing the power demand. At the same time the pilot will be using the cyclic control to maintain the position of the helicopter over the ground. Simultaneously the pilot will also be moving the tail rotor pedals to prevent the aircraft from turning. The helicopter is working very hard during this phase of lifting off of the ground and proceeding into forward flight, and an enormous amount of power is required. As the pilot increases the collective, the pitch of each blade is consecutively changed which provides the lifting force. The aircraft is now off the ground, and beginning to move forward. With each knot of forward speed the rotor system becomes more effective. Eventually, when the aircraft reaches the desired altitude and airspeed, it requires a significantly lower power setting and the helicopter is at a point of equilibrium. The cyclic is used to steer the helicopter in flight, the collective is used to provide the desired power, and the tail rotor pedals are used to trim the helicopter to its best aerodynamic profile (energy efficiency).

Once the helicopter arrives at its destination, a reversal of takeoff events occurs. The pilot lowers the collective to take the pitch out of the blades, which allows the helicopter to slow down and descend. This will in turn require a bit of aft cyclic to prevent the aircraft from descending and/or going too fast. As the helicopter slows and nears the ground, it will be necessary to increase the power (collective), because the blades are less efficient and require more power to fly. This increase in power demand will continue until the helicopter is no longer moving forward. It will then be necessary to actually decrease or lower the collective (power) to land.

This is a simplified description of how a helicopter flies! I hope you enjoyed your first virtual helicopter flight.

Steve, Director of Maintenance, completes the log book during an engine safety inspection.

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