



Federal Air Surgeon's Medical Bulletin

Aviation Safety Through Aerospace Medicine

For FAA Aviation Medical Examiners, Office of Aerospace Medicine Personnel, Flight Standards Inspectors, and Other Aviation Professionals.

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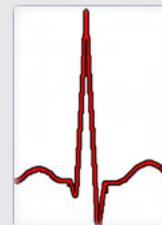
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NEW AEROSPACE MEDICINE LEADERS ANNOUNCED

FAA OFFICE OF Aviation Safety Associate Administrator **Peggy Gilligan** welcomed two new members to the senior leadership staff on March 13 to fill vacant positions. “I’m pleased to announce the selection of Dr. **Jim Fraser** as the new Federal Air Surgeon (AAM-1) and Dr. **Mike Berry** as the new Deputy Federal Air Surgeon,” she said. Both physicians “have a long history of valuable service to aerospace medicine and to aviation safety. We’re fortunate to have them continue their service as the new leadership team in this valuable work,” she concluded.



Dr. Fraser

Dr. Fraser, formerly the Deputy Federal Air Surgeon, replaces Dr. **Fred Tilton**, who retired in January of this year.

In this position, Dr. Fraser oversees the Office of Aerospace Medicine’s workforce of more than 400 physicians, research scientists, nurses, program analysts, and legal instrument examiners, including the Civil Aerospace Medical Institute, and more than 3,400 private physicians who administer FAA medical exams as designated medical examiners.

Eleven years ago, Dr. Fraser concluded a distinguished 30-year career with the United States Navy during which time he served the first 15 years in Family Practice. Following residency training he became a Naval Flight Surgeon and learned to fly Naval aircraft. He then took a second residency in Aerospace

Medicine and served as the Senior Medical Officer onboard the aircraft carrier U.S.S. Theodore Roosevelt, supervising a medical staff of 62 in a medical department that included a 67-bed hospital. He held other senior leadership positions and retired as Captain. “I believe the Navy provided me with incredible opportunities that prepared me well for my present duties and responsibilities, and I would do it again in a heartbeat,” he said.

After retiring from the Navy, he was selected as Manager Medical Specialties and served two years that position. For the past eight years, he served as the Deputy Federal Air Surgeon.

DEPUTY FEDERAL AIR Surgeon Michael Berry has eight years of FAA experience managing the Medical Specialties Division. He formerly was Chief of the Flight Medicine Clinic at NASA Johnson Space Center, where he was responsible for the screening and selection of new astronauts and participated in certification and training of astronauts for space flight.



Dr. Berry

Prior to NASA, Dr. Berry was an aviation medical examiner for 25 years.

Since joining the FAA, he has been responsible for medical certification policy for pilots and air traffic control specialists, medical appeals, FAA employee drug and alcohol testing, and substance rehabilitation programs for pilots and flight attendants.

QUESTIONS AND ANSWERS

Dr. Fraser, do you think the age rule for commercial pilots will be revised upward from age 65?

As we age, there is increasing risk to aviation safety. Physical and mental decrements such as decreased vision and hearing, and age-related memory decrements, poorer hand-eye coordination, but in particular, we are concerned about the increasing risk of sudden incapacitation. Statistics show that for a male age 40, compared to a male age 30, you are six times more likely to have a heart attack. At age 50, you are 36 times more likely to have that heart attack. And at age 60, you are 100 times more likely to have that heart attack, compared to a male age 30. Of course, one-third of all heart attacks present as sudden cardiac death. Not all only do the suddenly incapacitating issues concern us, but we are equally concerned about subtle incapacitation. According to the literature, in the U.S., by the time we reach age 65, five to eight percent of us have a diagnosable dementia...and you have to keep in mind that these numbers double every five years. So even though we are living longer, there are indeed risks, and it will be interesting to see if there will be congressional interest in moving up from age 65 to some number such as 70, so we look forward to playing in that process.

Dr. Berry, how is being an aviation medical examiner today different from when you were one?

In the last 25 years, what an AME can do and is expected to do and the types of medical conditions that the FAA is willing to give medical certificates for have changed greatly. When I was an AME in the late ‘70s, hypertension was a condition where there was only one medication available, and if you were not taking that medication, you were not going to fly and it certainly required a special issuance...the FAA had to give you your certificate, and not the AME. That is totally turned around today. We’ve got just about every medication on the market that exists that’s acceptable...only a few are not and they are very rarely used; so it’s no longer a special issuance type medical condition. That’s only a very small example. We are asking AMEs do a lot more than what I did when I first started out. It was an evolution, even during that 25 years’ perspective from the way it started out and the way it is now. AMEs are the eyes and ears of those of us in the Office of Aerospace Medicine—we train them to make sure pilots can meet the physical standards that are part of the federal regulations.

from the Federal Air Surgeon's
PERSPECTIVE...

BY JAMES R. FRASER, MD, MPH

ANCHORS AWEIGH

FIRST AND FOREMOST, I am indebted to my former boss, Dr. Fred Tilton. He was a great leader, mentor, and friend. In the decade that we worked together, he taught me a great deal. As he would often say, "Even though our primary mission is to keep the National Airspace System (NAS) safe, our secondary mission is to get every airman back up that we think can safely fly." I have long since adopted his philosophy regarding airman medical certification, and I fully intend to carry forward this philosophy.

I believe this philosophy is the major reason the FAA Office of Aerospace Medicine is widely considered as the gold standard for the world's medical certifying authorities. Most civil aviation authorities in other countries mirror the FAA medical standards contained in 14 CFR Part 67. In fact, many nations adopt these standards verbatim. Most importantly, we are much more progressive than other civil aviation authorities around the world when it comes to working with airman that do not meet the medical standards in Part 67.

The FAA special issuance process permits airman who do not meet Part 67 medical standards to obtain a special issuance medical certificate, and fly, but only when the risk of their underlying medical condition can be safely mitigated. We do this by time-limiting the medical certificate and requiring specialized follow-up and testing for renewal. Unfortunately, this willingness to work with every airman with a potentially disqualifying medical condition has significantly increased the complexity of medical certification and the workload of everyone. However, by applying safety risk-management processes, I believe we can improve the medical certification process while maintaining the FAA's international leadership.

In addition to preserving Fred's philosophy, I plan to make interfacing with our medical certification system more efficient and airman-friendly. I believe we can do this by leveraging the incredible knowledge and experience of our aviation medical examiners (AMEs).

At present, about ninety percent of all airman walk out of an AME's office with a new medical certificate. Not surprisingly, they are the ones most happy with our current system. This part of our medical certification system works

very efficiently for that ninety percent. Unfortunately, the ten percent of airman that must be deferred to the FAA are not always so happy because of the delay associated with the special issuance process. Although we do not have the statutory authority to allow AMEs to authorize a special issuance medical certificate, we do have tools that allow them to issue many more certificates.

Here's how I envision increasing the number of certificates issued by AMEs:

CACI. Conditions Aviation Medical Examiners Can Issue (CACI) is the first tool that can help us become more efficient. As the name suggests, CACI allows AMEs to issue a regular medical certificate for conditions that formerly required deferral to the Aerospace Medical Certification Division or the Regional Flight Surgeon (RFS). I would like to significantly increase the number of conditions that qualify for CACI, thereby expanding the number of airman that can leave the AME's office with a regular medical certificate in hand.

AASI. For those airman we can't help with CACI, I would like to expand the use of our Aviation Medical Examiner Assisted Special Issuance (AASI). Airman can take advantage of our AMEs to expedite renewing a special issuance. While an AASI doesn't help with their initial exam, it does make staying medically cleared a lot easier and quicker.

These are the first steps I propose to take. These steps will help the ten percent of airman that are presently deferred, while still upholding the safety of our National Airspace System. Ultimately, I'd like to cut that ten percent of deferred applicants who have to take a longer path to obtaining medical certification down to eight, or even five percent. We will increase the number of pilots leaving the AME's office with their medical certificate, and the airman certification staff will have more time to manage the more challenging cases that will still require deferral.

I am honored and delighted to be your Federal Air Surgeon. I look forward to expanding my association with my FAA colleagues, AMEs, and the aviation community. Incidentally, when I travel to the AME seminars and see you there, please say hello and let me know what's on your mind.

—Jim

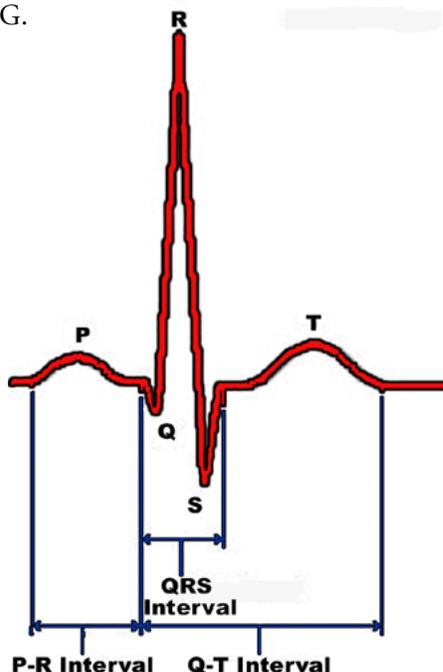
ECG NORMAL VARIANT LIST

(Revised 1/30/14)

These are considered normal 12-lead electrocardiogram variants. Applicants that have these findings may be certified, if otherwise qualified.

- Sinus bradycardia. HR (heart rate) >44 up to age 49; HR >48 age 50 and older
- Sinus tachycardia. HR < 110
- Sinus arrhythmia
- Low atrial rhythm
- Ectopic atrial rhythm
- Wandering atrial pacemaker
- One PVC (premature ventricular contraction)
- Multiple PACs (premature atrial contractions) – asymptomatic
- First-degree AV (atrioventricular) block with PR interval less than 0.21 in age <51
- Incomplete RBBB (right bundle branch block)
- Intraventricular conduction delay
- Early repolarization
- Indeterminate axis
- Left axis deviation, less than or equal to -30 degrees
- Short QT – if no history of arrhythmia
- Left ventricular hypertrophy by voltage criteria only
- Low voltage in limb leads (may be a sign of obesity or hypothyroidism)
- Left atrial abnormality

Note: If a first-class airman does not have a current resting ECG on file but we have the tracings of any type of stress test (pharmaceutical stress, Bruce stress, nuclear stress, or stress echocardiogram) that was accomplished within the last year, we can usually accept that. A cardiac catheterization and/or a Holter monitor test are not acceptable in place of a resting 12-lead ECG.



AVIATION MEDICAL EXAMINER INFORMATION LINKS

AME Guide

www.faa.gov/go/ameguide

AME Training Information

www.faa.gov/go/ametraining

AMCS Online Support

www.faa.gov/go/amcssupport

Regional Flight Surgeon Contacts

www.faa.gov/go/rfs

Pilot Safety Brochures

www.faa.gov/go/pilotsafetybrochures

Multimedia Aviation Medical Examiner
Refresher Course (MAMERC):

www.faa.gov/go/ametraining

Medical Certification Information

www.faa.gov/go/ame/

MedXPress Login & Help

<https://medxpress.faa.gov>

MedXPress Video Page

www.faa.gov/tv/?mediaId=554

FASMB Archives

www.faa.gov/go/fasmb

CAMI Library Services

www.faa.gov/go/aeromedlibrary

Airman Education Programs & Aerospace Physiology
www.faa.gov/pilots/training/airman_education/aerospace_physiology/

2012 Medical Certification Statistical Handbook
www.faa.gov/data_research/research/med_humanfacs/oamtechreports/2010s/media/201325.pdf

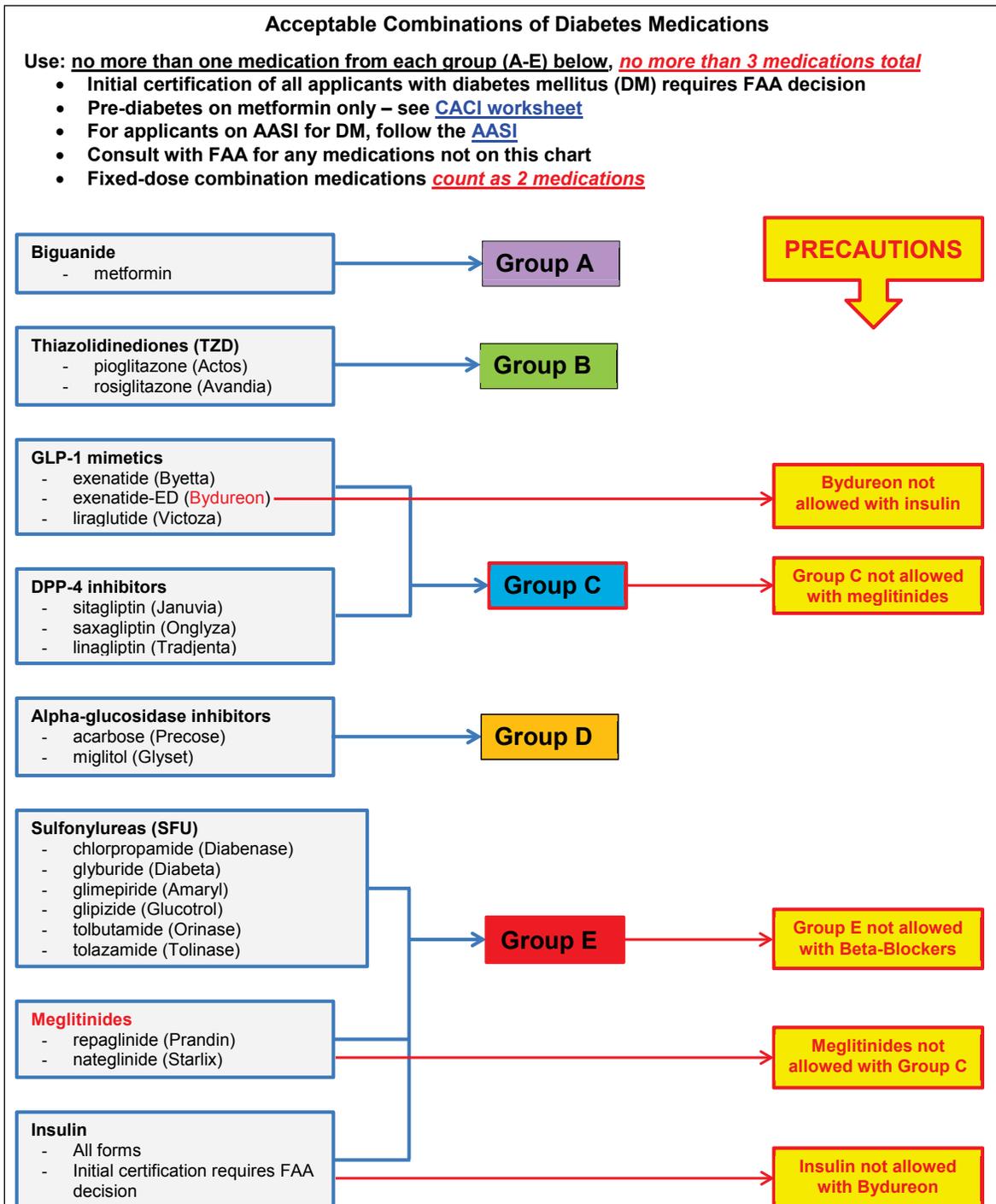
NEW PROTOCOL FOR DIABETES MEDICATIONS NOW IN AME GUIDE

By BRIAN PINKSTON, MD

LET'S FACE IT, although the medical management of diabetes has experienced major advances in recent years, it has become more complex from a medication standpoint. This increased complexity has a real impact on the aeromedical disposition of an airman, since we as aviation medical examiners are tasked with ensuring the safety of the National Airspace System. Subtle or sudden incapacitation due to hypoglycemia, other medication effects, or disease sequelae, remains at the forefront of our minds when making an aeromedical disposition regarding this disease entity.

Thankfully, Dr. **Arleen Saenger** and a team comprised of Dr. **Jim DeVoll**, Dr. **Denise Baisden**, and the Aerospace Medical Certification Division worked out an elegant and simplified approach to aeromedical disposition for combined medication regimens in this disease. It is available in the [Guide for Aviation Medical Examiners](#) and is shown below.

Dr. Pinkston manages the Aerospace Medical Education Division.



OAM PHYSICIANS ON CALL, PART 4

Conditions AME Can Issue (CACI)

BY RICHARD CARTER, DO, MPH

IN PART 1 of this series, we asked you to help us minimize our backlog of deferred examinations by issuing certificates when you can. In Part 2, we provided guidance for more complex cases that would require a verbal authorization to issue. In Part 3 of the series, we reviewed the theme of Cases/Conditions AMEs Can Issue (CACI) without a requirement to defer, or call for verbal authorization. Part 4 continues this process.

Issue when you can. A phone call to the Aerospace Medical Certification Division (AMCD) is not always required. The *Guide for Aviation Medical Examiners* provides instructions primarily in three sections of the *Guide*: Protocol, Dispositions, and Worksheets. (Note: Links are active.)

The **Protocol** section of the *Guide* ([Disease Protocols](#)) lists some conditions allowable for the AME to initial issue (see case example, intra-ocular lens).

The **Dispositions** section of the *AME Guide* ([Aerospace Medical Dispositions](#)) also lists conditions for which the AME can issue (see case examples, pulmonary embolism and testicular cancer).

The **Worksheet Section** ([CACI Certification Worksheets](#)), provides *more* conditions AME can issue—if specific worksheet criteria are met and correctly documented in Block 60 (see case example, migraine and chronic headache). Remember, for any of the above, we always need a summary of the medical condition provided in block 60.

So, What Is New? Take a look at the Archives section of the AME Guide to find posted changes and dates of the changes ([Archives and Modifications of the Guide for Aviation Medical Examiners](#)). A new CACI colitis worksheet was added in March 2014. The following is a list of current CACI conditions:

[Arthritis](#)

[Asthma](#)

[Colitis](#)

[Glaucoma](#)

[Hepatitis C - Chronic](#)

[Hypertension](#)

[Hypothyroidism](#)

[Migraine and Chronic Headache](#)

[Pre-Diabetes](#)

[Renal Cancer](#)

CACIs Without Certification Worksheets:

[Prostate Cancer](#)

[Testicular Cancer](#)

Case Examples. Note: Examples 1-3 are in the Part 3 article [[FASMB, vol. 51, no. 4, p. 4](#)].

Case Example 4 ([Protocol Section of the AME Guide](#))

[Cataract Surgery](#)

Third-class airman with an initial application, history of [cataract surgery](#) status post 3 years, using Crystalens implants, FAA-approved intraocular lenses (IOLs). See Protocol ([Binocular Multifocal and Accommodating Devices](#)).

Most intra-ocular lenses are fixed monofocal. There is no specified recovery period, although we suggest 10 days, minimum, to not fly after uncomplicated surgery. The airman should have made a good recovery, meet vision specs, and the cornea should be structurally stable enough that the ophthalmologist could prescribe glasses.

Other types of lenses are available, such as multifocal IOLs, which provide multi-focused vision. An example of a multifocal IOL (provides multiple-focused vision, at far and reading distances) is Crystalens, which is allowed by the FAA with a favorable eye report and no complications.

AME action: Summarize history in block 60. You may issue a regular certificate, and you do not need to call prior to transmitting the new exam. You can then issue the certificate and transmit the exam as outlined below:

- » Adaptation period before certification (surgical lens implantation, not multifocal): There is no specified recovery period, although we suggest 10 days, minimum, to not fly after uncomplicated surgery.
- » Adaptation period before certification (surgical lens implantation, multifocal or accommodating): minimum 3 months post-operative with current status report
- » Adaptation period before certification (contact lens, bifocal or multifocal): minimum 1 month of use
- » Must provide a report to include the FAA Form 8500-7 (Report of Eye Evaluation) from the operating surgeon or the treating eye specialist. This report must attest to stable visual acuity and refractive error, absence of significant side effects/complications, need of medications, and freedom from any glare, flares, or other visual phenomena that could affect visual performance and impact safety.

Continued on page 7

Example 5 (CACI Worksheet, and Aerospace Medical Dispositions Table of the AME Guide)

Classic Migraine

First-class pilot, medical status report, typical classic migraine with headache, sensitivity to light or sound, nausea and vomiting. Resolved with triptan. Less than one headache per month, no visual symptoms.

AME action: Refer to the Migraine and Chronic Headache worksheet. If all criteria are met, this is a CACI condition, so you may issue a regular certificate and make the appropriate notation in block 60.

Ocular/Ophthalmic Migraine

First-class pilot, medical status report, typical characteristics of ocular migraine: 1) 20-30 min duration, 2) involved vision ONE eye, 3) not associated with pain or headache. No therapy advised to prevent or control this type of migraine attack. Recurrence of ocular migraine is unpredictable.

AME action: Defer. We need a 3-6 month recovery period and further information. Note, Worksheet does not allow AME to issue for ocular migraine. This applicant can be considered for special issuance but not CACI.

Not all airmen with a CACI condition (in this case, migraine) will qualify for a CACI issuance. Be cautious of classic migraine with aura. The Migraine Worksheet does allow issuance for classic migraine, but the AME Guide also advises one to be cautious with the more complicated conditions. The classic migraine vision disturbances, which may consist of a scintillating scotoma (an area of partial alternation of field of vision), could interfere with safe aircraft operation. Some airmen may lose part of their field of vision. Remember: “*Not all applicants will meet CACI criteria*” (Protocol, Disposition Tables, Worksheets, or AASI criteria). Defer the case if the airman has complex migraine history, or call us for instructions.

Example 6 (Aerospace Medical Dispositions Table of the AME Guide)

Single Pulmonary Embolism

First-class pilot, 56 y/o, right lower chest pain associated with shortness of breath on laying supine. D-Dimer was positive (a fibrin degradation product by plasmin and it represents an endogenous thrombolytic process). The airman was started on enoxaparin (Lovenox) and switched to warfarin (Coumadin).

In a less complex case example, this airman had a single pulmonary embolus one year ago, was treated with warfarin for 3–6 months, which was then discontinued, with good prognosis, and there was no evidence of hypercoagulopathy.

AME action: Contact the AMCD or your Regional Flight Surgeon with the above information to be able to issue.

In a more complex version, the above airman’s daughter (25 years old) was recently diagnosed with deep vein thrombosis (DVT), and pulmonary embolism (PE) after a flight to Florida. Subsequent testing revealed a factor V Leiden deficiency in both the pilot and his daughter. After being worked up and treated, the pilot presented to his AME for guidance.

AME action: The examiner advised the pilot to provide a current detailed report and hospital records (consult with a hematologist or other specialist), to include an opinion about stability on warfarin treatment, and a discussion of the long-term recommendations. The airman did have a favorable medical summary, plus no further DVT or PE incidents. This AME called us with the above information, and we gave him verbal authorization to issue. The pilot was given an **AASI** (AME Assisted Special Issuance) for history of PE and DVT (the specialist was not entirely sure if the applicant had a previous DVT), and hypercoagulopathy.

Example 7 (Aerospace Medical Dispositions Table of the AME Guide)

Metastatic Testicular Cancer

A 26 y/o first-class pilot, after removal of a non-seminomatous germ cell carcinoma (2012), pursued an active course of surveillance and subsequently developed metastatic disease in his abdomen. He received standard course platinum-based chemotherapy, with shrinkage of the tumor from 6.0 x 2.7 cm in August 2012, to 3.9 x 1.3 cm in January 2013, suggesting the mass is now likely to be only necrotic tumor and scar tissue. He is under the care of an oncologist and continues to do well, with no further evidence of disease. Again, remember: “*Not all applicants will meet CACI criteria (Protocol, Disposition tables, Worksheets), or AASI criteria.*”

AME action: Defer such complex cancer cases.

Team Effort

We need your help to limit unnecessary deferrals. Many complex medical conditions do eventually get a waiver (special issuance or SODA), and we will help you with the certification process. Together, we can expedite the medical certification of pilots.

Coming in Next Issue (August 2014)

In Part 5 of this series, we will discuss more conditions and what information you should help your airman collect to expedite a medical certification decision.

Special thanks to my colleague, Judith K. Frazier MD, MBA, Aerospace Medical Certification Division, for her insightful review of the details provided in this paper regarding aeromedical disposition and the CACI protocols. Also thanks to Mark Ivey, MD, Jack Hastings, MD, and Richard Carlson, MD, for their helpful analysis.

Dr. Carter is a Medical Review Officer in the Aerospace Medical Certification Division.



COARCTATION OF THE AORTA

CASE REPORT, BY REBECCA BLUE, MD, MPH

This case report reviews a case of coarctation of the aorta with surgical repair in a student pilot applicant. A comprehensive review is provided of this cardiovascular abnormality, surgical correction, associated pathology, and concerns for medical certification. This review illustrates that, while there are circumstances in which coarctation or associated disease may be disqualifying, successful management of this problem can provide the opportunity for successful medical certification.

History

A 21-YEAR-OLD MALE PRESENTED to his aviation medical examiner for a first-time application for a third-class medical certificate to begin student pilot training. Review of the applicant's medical disclosures revealed that he had undergone surgical repair for coarctation of the aorta at age seven months. He was unable to provide a surgical report but reported primary end-to-end anastomosis. He also reported a history of a persistent left superior vena cava.

The applicant stated that he had been followed by pediatric cardiology throughout childhood without further problems, and he denied any history of hypertension, restenosis, or aortic aneurysm. He stated that he was generally well and exercised regularly in aerobic activity and high-intensity exercises, with no reported symptoms of chest pain, palpitations, or syncopal episodes.

On exam, he was found to have a well-healed surgical scar measuring 2 centimeters on the left lateral thorax consistent with the stated surgery. His heart rate was 68 beats per minute, with a blood pressure of 125/65. Pulses were equal in all extremities; the remainder of his exam was otherwise relatively unremarkable.

Angiography had been performed two years prior to the patient's presentation, with no evidence of residual coarctation. A recent echocardiogram demonstrated a normal valvular examination, a dilated coronary sinus consistent with a left superior vena cava, a descending aorta with a slightly decreased diameter distal to the subclavian artery, with peak velocity of 2.28 cm/sec and a peak gradient of 20.83 mmHg. Normal intracardiac anatomy and function was demonstrated, with an ejection fraction of >60%. A bubble study found no evidence of right-to-left shunting.

Aeromedical Issues

Patients with coarctation of the aorta may have significant issues regarding the sequelae of cardiac outflow obstruction.^{3,7} including chronic and refractory hypertension that may be poorly controlled with medication. Ventricular hypertrophy and valvular disorders, particularly mitral and aortic stenosis, may occur as a result of chronic obstruction.³

While hypertension may be the presenting symptom for an airman with an undiagnosed coarctation, it is incumbent upon the evaluating physician to identify the etiology of the hypertension and any related sequelae, such as hypertrophy or valvular disorders, particularly in a younger applicant. Although waivers may be granted for hypertension and associated medication use, a missed diagnosis of coarctation may have such serious consequences as syncopal episodes, severe ventricular hypertrophy, heart failure, aortic dissection, infective endocarditis, premature coronary artery disease, and mortality from any of these etiologies.^{3,4,7}

Outcome

This applicant had already undergone significant evaluation prior to his presentation to the aviation medical examiner (AME), including a current echocardiogram showing no significant sequelae and an angiogram demonstrating excellent blood flow with no evidence of restenosis. The AME appropriately deferred the patient to the FAA's Aerospace Medical Certification Division, which, after review of all documentation, authorized a special issuance for a third-class airman medical certificate. Follow up was required for two years after issuance, at which time the airman was to provide a current cardiac status report, with any imaging deemed necessary by his cardiologist.

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COARCTATION OF THE AORTA

Aortic coarctation is a birth defect that leads to the constriction of a part of the aorta, disrupting normal blood flow and requiring an increase in cardiac output to overcome this obstruction.¹ It is a relatively common defect, seen in as many as 5-8% of congenital heart defects and can be found in association with other cardiac defects or as a singular disease.¹ The most common location for a coarctation is at the level of the ductus arteriosus and may be associated with a patent ductus, generally presenting early in infancy.² Other etiologies include inflammatory and autoimmune reactions (in which case the coarctation may occur anywhere along the thoracic or abdominal aorta) or traumatic dissection with acute obstruction caused by disruption of the true aortic lumen. The latter is considered a surgical emergency and requires immediate intervention.^{1,7}

Due to the obstructive nature of the lesion, coarctation causes left ventricular hypertrophy by way of significantly increased afterloads.^{1,3} Presenting symptoms may range from unequal pulses through acute decompensated congestive heart failure.^{1,3} In particular, neonates that present with symptoms due to ductus closure (with resultant increases in constriction and, therefore, afterload) often demonstrate signs of severe congestive heart failure and frank shock.^{2,3} Other patients may initially be asymptomatic, and present much later in the disease course after the development of severe left ventricular hypertrophy and resultant hypertension or with the presentation of a heart murmur related to obstructed flow.⁴

Interestingly, the development of hypertension does not necessarily relate to the degree of aortic obstruction.⁵ Furthermore, many patients present with increased peripheral resistance even distal to the coarctation. The etiology is most commonly believed to be a result of reduced renal blood flow and resultant activation of the renin-angiotensin system.^{5,6}

Adults presenting with undiagnosed coarctation of the aorta may be asymptomatic and are most commonly diagnosed based on evidence of hypertension not otherwise explained, particularly with a pressure difference between the upper and lower extremities.^{4,7} Higher blood pressure noted in the upper extremities, with a difference of greater than 20 mmHg, is considered diagnostic.⁷ Adult patients may also present with undifferentiated systolic murmurs.⁷

Coarctation should be evaluated with an echocardiogram and/or angiography.^{3,4} Surgical intervention or balloon angioplasty (with or without stenting) is often required, commonly for patients with early presentations of coarctation during infancy or childhood.^{8,9} Post-surgical evaluation of patients, such as this applicant, should again include echocardiograms and/or angiography to identify any restenosis or obstruction and to evaluate the heart and heart valves for evidence of pathology, such as aortic stenosis, mitral valve disease, left ventricular hypertrophy, or other cardiac defects.^{3,8,9} Even after successful surgical repair of the lesion, patients may have chronic hypertension and require even life-long therapy, most commonly with beta-blockers, ACE inhibitors, or angiotensin II antagonists.^{3,4} Patients should receive endocarditis prophylaxis before any invasive procedures.³

The prognosis for patients, such as this applicant, with good surgical outcomes and normotension is generally good, with no restrictions to their activity levels. Complications in surgery, restenosis, aneurysms, and chronic hypertension have variable prognoses.^{8,9}

Of note, a left superior vena cava, while considered a morphological abnormality, is usually a benign finding, except that is often associated with other cardiac abnormalities, particularly congenital defects.¹⁰

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About the Author

Dr. Rebecca Blue was a resident in aerospace medicine at the University of Texas Medical Branch when she wrote this case report. The report was authored while she completed her training at the Civil Aerospace Medical Institute in Oklahoma City, Oklahoma. She is currently a flight surgeon for Virgin Galactic, LLC, and is an assistant professor in the Department of Preventive Medicine and Community Health at the University of Texas Medical Branch.



AEROMEDICAL CONSIDERATIONS OF CEREBRAL CAVERNOUS MALFORMATION

CASE REPORT, BY JOHN E. MOORE, MD, MPH & CHRISTOPHER A. ORSELLO, MD, MPH

History

AT OVER 15 years' military service and 3,000 hours as a U.S. Navy aircrewman, an asymptomatic 33-year-old male with two elder siblings, one diagnosed with cerebral arteriovenous malformation (AVM) and cerebral cavernous malformation (CCM) and the other diagnosed with AVM, underwent MRI due to concern for familial CCM.

His MRI revealed three left-sided supratentorial CCMs, the largest of which measured 1.5 centimeters, and punctuate microhemorrhages throughout the cerebral hemisphere. He continued to remain asymptomatic with normal neurological exams, and prior to this finding was considered fully physically qualified for his duties.

Aeromedical Concerns

The primary aeromedical risks associated with the diagnosis of CCM are those of sudden or subtle incapacitation; 20-30 percent of those with CCM will be symptomatic at some time in their lives, with the peak incidence of symptoms occurring during the third to fifth decade of life.² The most common presenting symptom is that of seizure (58%), followed by focal neurological deficits and acute hemorrhage. After initial diagnosis, 4.3% of patients will have seizures at some time during their lives.⁵ Of those presenting with seizure, 30% will have tonic-clonic episodes or focal episodes that generalize. The presence of a CCM carries a 2.4% per person-year risk of seizure, with the median age of first seizure at 42 years.^{5,6} Lesions that are supratentorial most commonly present as seizures, while those that are in the brainstem most frequently present with focal neurological deficits.⁵ Other common neurological symptoms include sensory changes, vertigo, and diplopia.^{3,5}

Rates of cerebral hemorrhage range from 2.4-10.6%, although all published rates are in question since the risk of hemorrhage increases with the number of lesions, and de-novo formation of new lesions occurs at a rate of 0.4 lesions/patient/year.³ The clinical presentation of CCM-related hemorrhages ranges from mild to fatal.⁸ Many hemorrhages are, in fact, asymptomatic. In a study of 40 cases of the familial form of CCM, LaBauge and colleagues found that two-thirds of hemorrhages were asymptomatic and discovered only on routine MRI.⁴ The most important risk factors for a clinically significant hemorrhage are history of a previous hemorrhage, deep

Cerebral cavernous malformations (CCMs) offer a unique and important challenge to the aviation medical examiner. Their presence increases risk for sudden incapacitation during flight, with primary concern for seizures, cerebral hemorrhage, and other neurologic sequelae. CCMs are not uncommon, representing up to 15% of all cerebral vascular malformations and have an estimated prevalence of 1 in 200-600.¹ While this case describes CCM in a military airman, trends such as increased use of imaging and broader understanding of familial and of sporadic CCM, increase the likelihood that this disease will be seen more frequently in civil aviation.

location in the brain, number of lesions, and familial form of the disease. Hemorrhage rates for those with familial CCM have been found to be up to 4.3 - 13% per patient-year, however these numbers include asymptomatic hemorrhages.⁵ Lesion size has not consistently been shown to predict bleed frequency, but symptomatic lesions tend to be larger than those that are asymptomatic.^{2,3,7} Re-bleeding is common, with rates published between 5-60%, and a median time to second hemorrhage of 8 months. Published studies vary widely in regards to re-bleed rates, but a common trend is that higher re-bleed rates are seen in those patients with more severe initial hemorrhages and in females.^{8,9} Some studies have shown a gradual decrease in re-bleed rate after 2-3 years, while others have shown continued elevated risk.^{3,10}

Surgical resection has consistently been shown to produce excellent results when lesions are symptomatic and supratentorial. Most published series demonstrate significant reduction or cessation of symptoms with low associated morbidity and very low mortality. Multiple series evaluating the resection of lesions located in deeper structures and the brainstem have also consistently demonstrated favorable long-term outcomes but with more associated morbidity than resections of more superficial lesions. Tarnaris and colleagues evaluated published reports of brainstem CCM treatment and compared conservative management (observation) to surgical resection and found a statistically significant difference in outcomes favoring surgery.³ Several guidelines have been published and most recommend following asymptomatic lesions with MRI every 1-2 years and surgical resection for symptomatic lesions in areas shown to have favorable outcomes. In patients who have multiple lesions or a history suggestive of the familial form of CCM, genetic testing for confirmed chromosomal mutations is recommended for the patient and family members. Those who are at high risk because of genetic mutation should be followed annually by MRI.^{3,7}

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Role of the AME

The presence of CCM in airmen requires thoughtful consideration and directed evaluation by the aviation medical examiner, particularly due to the potential for incapacitation. Like other cerebral vascular malformations addressed in the *Guide for Aviation Medical Examiners*, cavernous malformations require the AME's deferral to the FAA Aerospace Medical Certification Division (AMCD) for consideration of a special issuance. Submission requirements include all pertinent medical records, current neurologic specialist evaluation and report, the names, dosages, and side-effects of medication, when applicable.¹¹

Outcome

Based on the MRI results, the airman's flight surgeon consulted the U.S. Navy aviation neurology specialist who recommended the airman be suspended from flight duties. A U.S. Navy aeromedical waiver, the equivalent of an FAA special issuance, was requested but denied, citing concern for elevated risk of seizure and hemorrhage. The airman appealed this decision, and the result is pending.

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ETIOLOGY

Cerebral cavernous malformations (CCM) are one of three types of cerebrovascular malformations that are estimated to affect more than 3 million Americans. CCMs represent up to 15% of cerebral vascular malformation and have an estimated prevalence of 1 in 200-600.¹ The incidence of CCM is rising, with most experts attributing this to increased use of MRI. CCMs can be sporadic or familial. Sporadic lesions are most often single, while those associated with the familial form are commonly multiple. The inheritance of the familial form is autosomal dominant with variable penetrance. Half of familial lesions are found in Hispanics of Mexican origin. The major risks associated with CCMs are seizure, focal neurological deficits, and hemorrhage, with seizure being the most common presenting symptom, with a median age of presentation of 42 years.^{5,6} Prospective familial studies report annual hemorrhage rates of 4.3%–13% per patient-year and an annual risk for recurrent hemorrhage that declines from 18% in the first year after hemorrhage to 3% by 5-10 years after hemorrhage.^{1,5} Other symptoms may include headache, vertigo, diplopia, and sensory deficits. Treatment is largely dependent on symptoms, lesion location, and whether there is suspicion for the familial form of the disease. Surgical intervention has been highly successful for symptomatic supratentorial lesions.³ Asymptomatic lesions should be followed radiologically with MRI every 1-2 years. For those patients who are suspected to have a familial form, the addition of genetic analysis should be recommended for the individual and family members.³

About the Authors

John E. Moore, MD, MPH, CDR, MC, USN and Christopher A. Orsello, MD, MPH, CDR, MC, USN were residents in aerospace medicine when they wrote this case report at the Civil Aerospace Medical Institute. Both are board-certified family medicine physicians and currently command the medical departments of aircraft carriers USS Nimitz and USS Vinson, respectively.



ADENOID CYSTIC CARCINOMA

CASE REPORT, BY ANDREW W. SCHIEMEL, MD

Adenoid cystic carcinoma (ACC) is a rare epithelial tumor entity and comprises about 1% of all malignant tumor of the oral and maxillofacial region.¹ The long natural history of this tumor, its propensity for perineural invasion, and its tendency for local recurrence are well known.² It is a slowly growing but highly invasive cancer with high recurrence rate; however, patients undergoing complete surgical excision have shown excellent rates of 5-year disease-free state and survivability.³ This article presents a case report of a third-class pilot who developed a parotid adenoid cystic carcinoma and underwent successful surgical excision. A brief review of disease pathophysiology, outcomes associated with treatment, and aeromedical concerns is included.

History

A 67-YEAR-OLD MALE THIRD-CLASS pilot with over 3,500 hours of flight time applied for third-class medical recertification roughly 6 months following excision of a right parotid adenoid cystic carcinoma. While initial presentation specifics are unavailable, the patient was evaluated and found to have a 2 x 2 centimeter mass in the right parotid gland. Right parotidectomy was recommended as a definitive course of action, and the patient underwent surgery in October 2010. The right parotid gland was removed in its entirety, along with two regional lymph nodes. Operative report notes the facial nerve was untouched.

Pathology report noted complete excision of the offending tumor with 1mm clear margins, and the two regional lymph nodes were without evidence of carcinoma. Liver function tests and chest x-ray were negative.

Evaluation by the pilot's aviation medical examiner (AME) in May 2011 revealed well-healed right preauricular/neck surgical scars, no evidence of masses or lymphadenopathy on head and neck examination, normal neurological findings, and a normal conversational voice test at 6 feet. The remainder of the examination was unremarkable. An evaluation by the patient's surgeon, in support of the medical certificate application, was included. The surgeon's note reported no palpable masses or lymphadenopathy on the neck or parotid beds, intact facial nerves bilaterally, and normal computed tomography imaging of the head, neck, and chest.

Aeromedical Issues

In all cases, the primary aeromedical concern remains the same – is the pilot at risk of sudden or subtle incapacitation as a result of the medical diagnosis? According to the Aeromedical Certification Reference Manual, “the risk for sudden or subtle incapacitation can arise from the primary cancer itself, paraneoplastic effects of cancer, the side effects of cancer treatment, and effects of metastases.” In this particular case, the answer is straightforward. The primary cancer was completely excised,

the airman has suffered no obvious paraneoplastic effects, tumor progression, or metastases, and he is free of post-surgical complications. We'll examine issues for the AME a bit further along, but a discussion of a few potential aeromedical issues related to salivary gland tumor excision is in order prior to moving forward.

Additional aeromedical concerns surrounding this case involve two related but separate issues. Each has to do with the potential for damage to cranial nerve VII – the facial nerve – during tumor excision. While the parotid gland is in proximity to the more distal aspects of the nerve, it is important to nonetheless evaluate for potential nerve damage from excision. The most obvious concern revolves around potential symptoms of nerve palsy such as drooping facial musculature and dry eyes due to inadequate lid closure and poor parasympathetic-driven secretion from the lacrimal glands. While the latter would produce a mere annoyance, the former may affect a pilot's ability to properly don an oxygen mask and achieve an adequate seal. Adhesion or scarring related to surgical procedure might compound this difficulty.

The other concern regards the facial nerve branch that innervates the stapedius muscle. Damage proximal to this branch of the facial nerve would result in wider oscillation of the stapes and subsequent heightened reaction of the auditory ossicles to sound vibration. This condition, known as hyperacusis, causes normal sounds to be perceived as very loud and might interfere with proper communication in the cockpit and with controllers.

Role of the Aviation Medical Examiner

The general medical standards for medical certificates annotated in Title 14 of the Code of Federal Regulations subsections 67.133, 67.213, and 67.313 include no functional or structural disease, defect, or limitation that makes the person unable to safely perform the duties or exercise the privileges of an airman.⁴ AMEs are authorized to examine airmen to determine whether or not they meet these standards.

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CAMI'S FIRST POSTMORTEM AVIATION TOXICOLOGY COLLOQUIUM HELD

THE FAA CIVIL Aerospace Medical Institute (CAMI) recently held its first three-day colloquium on Postmortem Forensic Toxicology in Aviation. Those attending were aerospace medicine scientists, accident investigators, educators, medical examiners, forensic toxicologists, and students. Included were representatives from the Department of Justice, National Aeronautics and Space Administration, National Transportation Safety Board, CAMI, and the private sector. Geographically, they came from Brazil, Canada, Spain, Turkey, and a cross-section of America.

In the case of a patient with a tumor of the parotid gland, the AME should fill the dual role of examining the patient thoroughly and facilitating the collection of supporting documentation needed for a potential special issuance. Physical examination in this case should confirm adequate healing of surgical incision, absence of lymphadenopathy or masses, proper hearing acuity and lack of a history of hyperacusis, and normal facial nerve function with regard to innervation of the facial musculature. Standards for the third-class medical certificate head and neck examination are outlined in §67.305 of the aforementioned Code of Federal Regulations.⁵

Outcome

The airman was issued a time-limited special issuance following submission of a full clinical evaluation 6 months status post his parotidectomy and tumor excision by a qualified surgeon. The evaluation included documentation of normal facial nerve function and a well-healed surgical scar, along with normal head/neck/throat examination absent of masses or lymphadenopathy. Diagnostic studies included a negative head/neck/chest computed tomography scan and a normal liver panel. Per requirements set out in the *Guide for Aviation Medical Examiners*, the special issuance requires annual follow-up with submitted documentation of similar evaluation to ensure no return of the primary tumor, no metastases, and no clinical manifestation of disease related to same.

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About the Author

Andrew W. Schiemel, MD, MPH, CDR MC (FS) USN, was a Resident in Aerospace Medicine when he wrote this case report at the Civil Aerospace Medical Institute. Currently, he is serving as the Senior Medical Officer on the USS John C. Stennis, based in Bremerton, Washington.

TOPICS

Topics covered included sample processing; importance of chain of custody samples; analyses of samples for combustion gases, ethanol, and drugs; analytical results interpretation; significance of quality control/quality assurance; new exponential technologies in forensics; and litigation and expert testimony issues. Two panel discussion sessions highlighted the conference's important focal points, which were on "Interpretation of Analytical Results and Interesting Cases" and "Litigation and Expert Court Testimony." In these sessions, the participants actively shared their deep interests and expertise in these highly technical subjects.

The contact person for this colloquium was **Arvind K. Chaturvedi**, PhD, Biochemistry Research Team Coordinator in CAMI's Aerospace Medical Research Division.

NEXT TIME: CME PLANNED

The Civil Aerospace Medical Institute plans to host a similar colloquium in 2017 and will offer Continuing Medical Education credit through its Aerospace Medical Education Division.

CAMI is located at the Mike Monroney Aeronautical Center in Oklahoma City, Okla.



LETTERS TO THE EDITOR

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Send Email To:

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INTERNATIONAL AME SEMINAR SCHEDULED FOR MUNICH, GERMANY

All physicians interested in aerospace medicine welcome

By BRIAN PINKSTON, MD

THE EUROPEAN SCHOOL of Aviation Medicine (EUSAM) will conduct an international aviation medical examiner seminar in Munich, Germany, August 21-24, 2014. EUSAM has invited Drs. **Melchor Antuñano**, **Courtney Scott**, and **Brian Pinkston** from the FAA Office of Aerospace Medicine to participate to the degree necessary to consider the training equivalent to an FAA aviation medical examiner (AME) refresher seminar.

Continuing Medical Education Credit will be given for seminar attendance to those AMEs requesting it, if a passing score is obtained on an FAA test administered after the seminar. Guest lecturers from Germany will provide the clinical lectures normally given at FAA seminars and will also give other presentations in aviation medicine and human factors.

Participation by physicians representing other civil aviation authorities will engender fruitful discussion of the aeromedical significance of a multitude of medical conditions and contrast the approaches taken by other countries regarding pilot medical certification.

The Academy welcomes all physicians interested in aviation medicine, whether or not they are FAA examiners. However, we encourage AMEs (particularly those residing in Europe and the Middle-East) to consider attending this seminar as an alternative to our regular AME seminars offered within the U.S. or if you just want a different training experience.

Closing date for applications is **MAY 19, 2014**. For more information, see the EUSAM website:

www.flugmed.org/Stundenplaene/ame_application_form.pdf

Dr. Pinkston manages the Civil Aerospace Medical Institute's Aerospace Medical Certification Division.



2014 AME SEMINAR SCHEDULE

May 12-15	San Diego, California	AsMA (1)
July 14-18	Oklahoma City, Oklahoma	Basic (2)
August 8-10	Bethesda, Maryland	OOE (3)
August 21-24	Munich, Germany	Refresher
October 9-11	Reno, Nevada	CAMA (4)
October 27-31	Oklahoma City, Oklahoma	Basic (2)
November 21-23	San Antonio, Texas	CAR (1)

NOTES

- (1) A 3½-day theme AME seminar held in conjunction with the Aerospace Medical Association (AsMA). This seminar is a Medical Certification theme, with aeromedical certification lectures presented by FAA medical review officers, in addition to other medical specialty topics. Registration must be made through AsMA at (703) 739-2240. A registration fee will be charged by AsMA to cover their overhead costs. Registrants have full access to the AsMA meeting. CME credit for the FAA seminar is free.
- (2) A 4½-day basic AME seminar focused on preparing physicians to be designated as aviation medical examiners. Call your Regional Flight Surgeon.
- (3) A 2½-day theme aviation medical examiner (AME) seminar consisting of aviation medical examiner-specific subjects plus subjects related to a designated theme. Registration must be made through the Oklahoma City AME Programs staff, (405) 954-4831. NEU= Neurology, OOE= Ophthalmology-Otolaryngology-Endocrinology, CAR= Cardiology.
- (4) This seminar is being sponsored by the Civil Aviation Medical Association (CAMA) and is sanctioned by the FAA as fulfilling the FAA recertification training requirement. Registration will be through the CAMA Website:

www.civilavmed.com.

The Civil Aerospace Medical Institute is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians.



NEW AVIATION MEDICAL EXAMINERS ATTEND AME “BOOT CAMP” MARCH 24-28 IN OKLAHOMA CITY, OKLA. They are pictured at the Civil Aerospace Medical Institute with AMED Manager Dr. Brian Pinkston (kneeling, 2nd from left). During Fiscal Year 2014, about 90 physicians attended the Basic seminars, 350 attended various “Theme” seminars, and 258 AMEs completed the Multimedia Aviation Medical Examiner Refresher Course (MAMERC).