

You're the Flight Surgeon

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You're the flight surgeon in a carrier air wing currently on detachment in Nevada conducting training missions in preparation for deployment. A 28-yr-old male F/A-18F weapon systems officer presents to your flight line clinic with a 3-d history of sore throat, ear popping, muffled hearing, fevers, chills, and aural fullness that is worse on the right side. He denies the presence of cough. He does not have a history of allergy symptoms or drug allergies and is not presently taking any medication.

His temperature is 98.2°F. Other vital signs, including peripheral arterial oxygen saturation, are within normal limits. Direct otoscopy on the right reveals an inflamed and bulging tympanic membrane with opaque white fluid present in the middle ear and loss of middle ear landmarks. He also exhibits posterior oropharyngeal erythema with bilateral tonsillar exudates. Upon additional questioning he admits that his sore throat had been present for several more days prior to presentation, but he was able to clear his ears and elected to wait before seeking medical care. Although he is presently afebrile, he reported a history of fever to 101.3°F a day prior to presentation. There is tender anterior cervical lymphadenopathy present on the right. The rest of the physical exam is unremarkable. Four out of four Centor criteria are present.³ Point-of-care testing for group A *Streptococcus* is positive.

1. What is the next best step in the evaluation?

- A. Chest X-ray.
- B. Audiometry.
- C. Complete blood count.
- D. Tuning fork hearing assessment.

ANSWER/DISCUSSION

1. D. The next best diagnostic step is to delineate conductive from sensorineural hearing loss via tuning fork examination using the Weber and Rinne screening tests. Audiometry would help to further delineate the degree of any hearing loss that is present and should be considered after an initial assessment with a tuning fork.

The presented patient exhibits four of four Centor criteria. This indicates a 56% probability of a positive culture of group A *Streptococcus* and led to initial screening with a point-of-care test.³ The Centor criteria are four clinical findings that correlate with the likelihood of a positive bacterial culture of group A *Streptococcus* as the etiology of

pharyngitis. The criteria are tonsillar exudates, swollen tender anterior cervical nodes, lack of a cough, and history or presence of fever. When less than three criteria are met, diagnostic screening with a rapid test is generally not recommended due to the low pretest probability of group A *Streptococcus* being present.

In the absence of respiratory complaints, abnormalities on pulmonary exam, or abnormal vital signs, chest X-ray is unlikely to affect management at this point. Likewise, a complete blood count or other laboratory blood draw at this initial evaluation is unlikely to add useful information to the clinical picture for the same reasons.

2. What results would you expect of Weber and Rinne testing on this patient?

- A. Weber: does not lateralize; Rinne: air conduction (AC) > bone conduction (BC) bilaterally.
- B. Weber: lateralizes to the right; Rinne: BC > AC on right, AC > BC on left.
- C. Weber: lateralizes to the left; Rinne: AC > BC bilaterally.
- D. Weber: lateralizes to the left; Rinne: BC > AC on left, AC > BC on right.

ANSWER/DISCUSSION

2. B. The Weber test has the examiner place a vibrating tuning fork (512 Hz) at the vertex of the forehead and ask the patient to identify on what side the sound is louder. A normal exam is when the sound is heard equally on both sides (option A). In the setting of a conductive impairment, vibrations through bone bypass the problem in the middle ear to reach the cochlea, resulting in improved detection and a subjectively louder sound on the affected side.¹ Conversely, the Weber test may lateralize to the unaffected ear in the case of sensorineural hearing loss of the contralateral ear (option C). Option D describes a conductive deficit of the left ear.

The Rinne test involves placing a vibrating tuning fork to the mastoid and, when the patient can no longer hear the sound, the tuning fork is moved to approximately 1" lateral to the ear canal with the "U" shape of the fork facing forward. A normal finding is when the sound

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is heard longer through air than through bone (option A). In conductive hearing loss, the sound is heard via bone conduction as long as or longer than via air conduction.¹

3. Of the choices listed, what is the most appropriate treatment option for him at this time?

- A. Oral antibiotics.
- B. Oral corticosteroids.
- C. Therapeutic myringotomy.
- D. Oral and/or nasal decongestants.

ANSWER/DISCUSSION

3. A. In the setting of unilateral suppurative otitis media with resultant conductive hearing loss on exam in a designated military aviator exhibiting four of four Centor criteria and a positive rapid strep test, oral antibiotics should be prescribed. Untreated suppurative otitis media carries risk of complications, including intratemporal conditions such as mastoiditis, labyrinthitis, and sensorineural hearing loss, and extratemporal complications, such as abscesses, meningitis, and lateral sinus thrombosis.¹¹

It is important to keep in mind the operational status of this aviator, who is undergoing high operational tempo training syllabi with his squadron in preparation for deployment. His ability to rapidly return to flight status while mitigating risk of further complications is best achieved with appropriate antibiotic therapy. The other answer choices are not indicated (option B), poorly studied and more appropriate for chronic otitis media with effusion or as an adjunct therapy for mastoiditis (option C), or have not been shown to provide additional benefit (option D).⁹

He is started on oral amoxicillin 500 mg every 8 h. He returns to clinic 2 d later with a progressive rash of 24 h duration. Skin examination reveals blanching fine papular erythema with a sandpaper-like texture on his anterior neck, upper chest, axillae, lower back, buttocks, and medial thighs. These areas are mildly pruritic and painful. Observed papules and pustules do not uniformly affect hair follicles in the described areas and he denies recent hot tub use. His left axilla prominently exhibits nonblanching petechial patches in linear configurations (**Fig. 1**, arrowheads). These are present on the right side to a lesser extent (**Fig. 2**). There is no palpable axillary lymphadenopathy bilaterally. A few pustules are present on his upper chest (**Fig. 3**).

4. What is the most likely diagnosis?

- A. Folliculitis.
- B. Miliaria rubra (heat rash).
- C. Scarlet fever.
- D. Exanthematous drug eruption.

ANSWER/DISCUSSION

4. C. The findings of unilateral suppurative otitis media, group A streptococcal pharyngitis, and fine papular rash are consistent with a diagnosis of scarlet fever.²³ Additional classic findings include circumoral pallor and strawberry tongue. The rash of scarlet fever is



Fig. 1. Scarlatiniform rash of the left axilla with linear patches of petechiae that do not blanch, known as Pastia's lines (arrowheads). See the online version of this article for color.

due to the inflammatory response to pyrogenic exotoxin.²³ The linear arrangements of petechiae are a pathognomonic component of the scarlatiniform rash known as Pastia's lines.²³ It is expected that the rash of scarlet fever may desquamate several days after initial presentation and ultimately resolve with no additional treatment aside from continuation of appropriate antibiotics.²³

Folliculitis represents a superficial infection of hair follicles, with erythematous papules or pustules present in a strictly follicular distribution. Miliaria rubra (heat rash), while often presenting on the trunk and expected in military personnel operating in hot environments, would not be expected to present with petechiae.

A drug-induced exanthem is certainly part of the differential for scarlet fever but is a less likely answer choice in the absence of urticaria and in the presence of a papular and pustular rash. Withdrawing the antibiotic in favor of a different class of antibiotic is reasonable, but again, the other features that are present suggest a diagnosis of scarlet fever; thus, treatment should be continued with close observation for signs of systemic involvement.

Just below the area of fine papular erythema on the right axilla are slightly larger nonblanching and darker red-appearing petechiae on the right thorax along the midaxillary line (**Fig. 2**, asterisks). The petechiae are observed in a random distribution without a background of erythema and are not arranged linearly. There are no other areas on the skin with similar-appearing lesions. Complete blood count with differential is normal.



Fig. 2. Scarlatiniform rash of the right axilla with collections of petechial hemorrhages secondary to sustained $+G_z$ exposure on the lateral aspect of the axilla and inferiorly on the thorax (asterisks). See the online version of this article for color.

5. What is the most likely etiology of this distinct petechial collection?

- A. Hypersensitivity vasculitis.
- B. Sustained high $+G_z$ exposure.
- C. Cherry angiomas.
- D. Drug-induced immune thrombocytopenia.

ANSWER/DISCUSSION

5. B. The petechiae affecting the flank are well known sequelae of exposure to the dynamic aviation environment. They are commonly known in the tactical jet aviation community as “Geasles,” short for “G-measles,” and are the result of $+G_z$ -induced (head-to-foot, i.e., the z-axis) extravasation of capillary beds in the skin.²⁴ These areas had been present since the patient’s last flight 3 d ago that involved dynamic maneuvering. Upon further interview, the patient was able to recount the specific maneuver that he surmises led to formation of the $+G_z$ -induced petechiae.

Small-vessel vasculitis involves vessel wall damage with subsequent erythrocyte extravasation via immune-complex deposition,



Fig. 3. Scattered erythematous pustules and papules on the neck and upper chest. See the online version of this article for color.

neutrophil chemotaxis, and eventual lysosomal enzyme release.⁸ It may present with cutaneous-only manifestations, but other organs can be affected such as the kidneys, heart, nervous system, gastrointestinal tract, lung, and joints.^{8,10} Characteristic lesions are palpable purpura (as opposed to isolated, nonpalpable petechiae), but may range from urticaria to blisters and ulcers.⁸ In the absence of other signs or symptoms implicating these organ systems, the likelihood of this option is considerably low.

Cherry angiomas are small, benign proliferations of dermal vascular tissue and, although they share a similar hue as the acceleration petechiae in Fig. 2, they tend to be isolated and blanch with pressure. They are most commonly found on the thorax of people with lighter skin tones and tend to increase in number with age.⁷

Drug-induced immune thrombocytopenia develops due to drug-dependent antiplatelet antibodies that result in platelet destruction.⁴ Easy bruising and cutaneous or mucosal bleeding can occur and, in rare cases, severe gastrointestinal bleeding is possible. This diagnosis is argued against by the normal platelet count in this patient.

AEROMEDICAL DISPOSITION

Acute upper respiratory infection, especially with evidence of otitis media, Eustachian tube dysfunction (ETD), and/or hearing loss does not meet required aviation medical standards in the Navy, Army, Air Force, and the Federal Aviation Administration (FAA) given the inherent threat to aviation safety.^{2,6,17,21} The patient’s symptoms place him at an unacceptable risk of barotitis and barosinusitis if exposed to the aviation environment prematurely, as aeration of the middle ear and sinuses is crucial to equalizing pressure in these spaces with changing ambient air pressure during flight.

Hearing loss of any type (conductive, sensorineural, mixed) beyond standard thresholds for aviation is considered disqualifying and requires additional testing and information to be provided to governing bodies prior to consideration of a waiver.^{6,12,14,19} His hearing loss must resolve prior to return to flight due to the obvious requirement that an aviator’s senses all be functioning optimally to be medically

cleared. If sensorineural findings were suspected or present and audiometry performed, he should undergo repeat testing to demonstrate a return to baseline and/or standards for aviation. If conductive hearing loss had persisted following initial treatment, he should be temporarily grounded and referred to an otolaryngologist for evaluation and audiometric testing, with follow-up testing required after additional management.

Dermatitis is a generic term referring to an inflammatory cutaneous disorder. The aeromedical safety concern involves the resultant symptoms of dermatitis, such as pain or pruritus, that may make the wearing of flight suits and equipment uncomfortable or distracting and therefore disqualifying for flight.^{13,18,21} Further mechanical irritation of an already inflamed skin barrier in the heat of the desert poses additional risk of superinfection. For these reasons, flight status should be avoided until resolution of all cutaneous symptoms.

In the Navy, aviation personnel on amoxicillin may be considered for an up chit prior to the completion of the course of therapy as long as the condition being treated has resolved in all significant aspects with no adverse reaction that might compromise safety of flight or mission completion.¹⁵

Army policy similarly allows for continuation on flight status with local flight surgeon approval and monitoring of amoxicillin use as a Class 2A medication.²⁰ As with the Army and Navy, amoxicillin use is temporarily grounding until the potential for idiosyncratic reaction has been ruled out and the acute infection becomes asymptomatic, with no waiver required for use in Air Force personnel.¹⁶ The Air Force Waiver Guide also specifically stipulates that acute ETD secondary to a transient illness (e.g., viral upper respiratory infection or seasonal allergic rhinitis) requires no waiver but is grounding for flyers until resolution, whereas chronic ETD is disqualifying and requires a waiver.²²

The FAA provides additional language. If ETD is acute and resolved, certification may be issued by the aeromedical examiner. If the disease is active or chronic, it requires FAA decision with the following caveat: if the condition is not a threat to aviation safety, the treatment consists solely of antibiotics and, when the antibiotics have been taken over a sufficient period to rule out the likelihood of adverse side effects, the examiner may make the certification decision.⁵

At his follow-up for evaluation 3 d later, the patient noted no significant change in his otalgia, ETD, and muffled hearing loss. He was continued on antibiotic therapy with gradual resolution of all symptoms over the next 5 d. He was subsequently medically cleared to fly after repeat physical examination was normal.

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