Navigating the Management of an F-16 Pilot Following Spontaneous Splenic Rupture

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BACKGROUND: Little consensus exists on the best practices for post-acute care of patients who suffer splenic injury but retain functional splenic tissue. Moreover, no published guidance or case reports exist for managing pilots in this demographic, making the flight surgeon's task particularly difficulty as he/she attempts to apply the best available evidence for a patient population exposed to unique occupational hazards.

CASE REPORT: We describe the case of an F-16 pilot who suffered a spontaneous splenic rupture due to infectious mononucleosis and required splenic artery embolization for hemodynamic stabilization. Despite the salvage of a significant portion of his spleen, the pilot was managed as an asplenic patient due to concern that: 1) splenic artery embolization compromised the function of his spleen; and 2) his status as a military aviator placed him at increased risk of infection due to frequent travel. He received appropriate vaccinations for an asplenic patient, fever precautions, and amoxicillin-clavulanic acid for immediate use if he developed fever. After discussion with the Aeromedical Consult Service, who felt the aviator had minimal risk of a poor outcome, he was returned to flying status. Since returning to flying status he has logged over 15 h of flight time, routinely experiencing 8–9 $+G_z$ without difficulty.

DISCUSSION: This case provides a successful approach to the management of pilots of high-performance aircraft who suffer splenic injury but retain functional splenic tissue, and provides precedent for safely returning these patients to flying status following recovery.

KEYWORDS: infectious mononucleosis, splenic artery embolization, spontaneous splenic rupture, gravitational force, acceleration.

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A total splenectomy poses significant health concerns for any patient, but especially military aviators whose occupation exposes them to unique physiologic stressors, and requires frequent travel to geographic locations endemic to organisms they have particular susceptibility to such as *Neisseria meningitidis* in Africa and Saudi Arabia.[10] Patients who undergo total splenectomy have increased risk of serious infection, sepsis, thromboembolic events, pulmonary hypertension, and malignancy. The extent to which these risks persist in patients who suffer splenic injury, but continue to have functional splenic tissue remains unclear.

Indeed, a literature search revealed no studies examining the risk of malignancy and pulmonary hypertension in patients who suffer splenic injury but retain functional splenic tissue. And while studies do exist suggesting decreased risk of thromboembolic events as well as relative immunocompetence in patients who suffer splenic injury, but retain functional tissue compared to those who undergo total splenectomy, many areas of uncertainty remain.[4,11] For example, it remains unclear whether the mechanism of splenic injury (e.g., spontaneous rupture vs. traumatic injury) has any relevance in the risk of thromboembolic events or immune status of the patient. It also remains unclear what negative consequences splenic artery embolization has on these outcomes—especially in light of new data suggesting patients who undergo splenic artery embolization have similar rates of infection to those that undergo total splenectomy.[8]

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Finally, managing complications such as rebleeding, splenic infarct, and/or secondary rupture associated with the use of increasingly common adjuncts to nonoperative care such as splenic artery embolization amplifies the difficulty of caring for these patients. This case of an F-16 pilot who suffered spontaneous splenic rupture details the successful navigation of the many decisional junctures that arise in the post-acute care of a pilot with splenic injury who retains functional splenic tissue.

CASE REPORT

A 33-yr-old previously healthy F-16 pilot presented to our flight medicine clinic in Alabama complaining of 14 d of fevers up to 101.6°F, night sweats, fatigue, and sore throat. Despite the sore throat he denied cough and congestion. He also denied ear pain, recent insect bites, diarrhea, and STI (sexually transmitted infection) exposure, reporting a monogamous relationship with his wife. He had developed the illness while vacationing in Florida and gone to the ER 7 d prior to his presentation at our clinic. The ER diagnosed him with a viral URI and discharged him with acetaminophen. However, his condition did not improve over the next week so he came to our clinic for evaluation.

On exam, vitals were within normal limits. Inspection of the posterior pharynx revealed erythema but no tonsillar exudates. No peritonsillar cellulitis or deviation of the uvula was noted. No lymphadenopathy was found, but splenomegaly was appreciated on abdominal exam. Examination of the skin revealed no rashes. The patient was grounded and several labs and imaging studies ordered. Rapid flu was negative. CBC (complete blood count) showed mild leukocytosis and CMP (comprehensive metabolic panel) showed mild transaminitis in a hepatocellular pattern. A heterophile antibody test was sent to an outside lab. Chest X-ray was unrevealing, but abdominal ultrasound revealed splenomegaly (16 cm) and subsequent CT chest/abdomen/pelvis with contrast revealed splenomegaly with small ascites. Two days later the heterophile antibody test came back positive, and the patient was cautioned about risk of splenic rupture.

Two days after learning he had infectious mononucleosis he experienced severe left upper quadrant pain while watching television and went to the ER where CT scan of the abdomen/pelvis with contrast revealed a splenic rupture. He was admitted to the STICU (Surgical & Trauma Intensive Care Unit) and initially treated conservatively, but he became hemodynamically unstable with hemoglobin dropping to 6.4 $g \cdot dl^{-1}$, heart rate rising into the 120s, and SBP dropping into the 90s. He was transfused 3 units of PRBCs (packed red blood cells) and interventional radiology performed a splenic artery embolization, inserting embospheres into the lower pole branch of the splenic artery to minimize arterial pressure and diminish bleeding. The patient tolerated the procedure well and remained hemodynamically stable after embolization. He was subsequently discharged, received vaccinations in accordance with current guidelines for asplenic patients, given amoxicillin-clavulanic acid for immediate use if he developed fever, and told to go to the ER for evaluation if he did develop fever.

He recovered uneventfully, and approximately 5 mo after splenic rupture the patient returned to flying status following a normal physical exam and CBC. Since returning to flying status he has successfully completed 11 sorties in an F-16, totaling over 15 h of flight time. He has routinely experienced 8–9 $+G_z$ without any adverse events.

DISCUSSION

While splenomegaly is seen in 50–60% of patients with infectious mononucleosis only about 0.001% experience splenic rupture.[2] Splenic rupture usually occurs about 2 wk after symptom onset, but can occur months afterward.[2] Typically, nonoperative management is preferred but in cases of hemodynamic instability and transfusion a splenectomy should be performed.[3] In light of our patient's hemodynamic instability and transfusion requirement, a splenectomy would have been a reasonable choice in accord with current guidelines; however, Intervention Radiology elected to perform splenic artery embolization, confident they could stop the patient's bleeding. Splenic artery embolization improves outcomes in nonoperative management of splenic injury, and while it is most efficacious in hemodynamically stable patients who do not require transfusion, it was used successfully in our patient.[5]

Immunizing patients with functional splenic tissue is controversial. Several studies suggest vaccination is unnecessary, but it remains unclear to what extent, if any, the mechanism of splenic injury and use of splenic artery embolization as an adjunct to nonoperative care affect immune function.[11] One recent retrospective analysis found that patients who underwent nonoperative management of splenic injury with splenic artery embolization suffered long-term infection rates similar to those who underwent total splenectomy, presumably because cutting off the blood supply to the spleen severely compromises its ability to carry out its immune functions.[8,11] Given the lack of consensus on immunizations following splenic artery embolization and the aforementioned increased risk of military aviators for infectious complications due to frequent travel we felt the benefit of immunizing the patient as if he had undergone a total splenectomy outweighed the risk; we proceeded with immunizing him in accord with current clinical practice guidelines for asplenic patients.[10]

As with immunizations, no consensus exists on antibiotic prophylaxis in patients who have suffered splenic injury but continue to have functional splenic tissue.[6] Given his status as a military aviator and the study mentioned above suggesting an immunocompromised state in those who undergo splenic artery embolization, we prescribed him amoxicillin-clavulanic acid to take immediately if he developed fever, and gave him instructions to go to the ER immediately for evaluation after taking the medication.

Patients with total splenectomy have increased risk for both arterial and venous thromboembolic events.[12] Thromboembolism following splenic artery embolization remains a significant concern, but rates are likely lower than those seen in total splenectomy.[4] No consensus exists on anticoagulating patients following total splenectomy or splenic artery embolization, and the majority of risk for a thromboembolic event exists in the weeks following the procedure.[7] As our patient was not placed on any anticoagulation at discharge from the hospital and we had concern for rebleeding we did not place him on any at follow-up.

Five months after spontaneous splenic rupture, the patient expressed a desire to return to flying status. The primary medical concerns with returning him to flying status revolved around risk of secondary rupture and rebleeding. Case reports do exist of traumatic artery dissections in high-performance aircraft, but a literature search revealed no such cases involving splenic vessels or any vessels that had previously undergone embolization.[1] As almost all of rebleeding and/or secondary rupture of the spleen occurs in the first 2 wk following the procedure and we identified no prior reports of splenic vessel pathology due to high $+G_z$, we categorized his overall risk for a bleeding event or secondary rupture to be low.[9] Consequently, we returned him to flying status after discussing the details of the case with the Aeromedical Consult Service who not only felt the patient could return to flying status, but that he did not require a waiver.

This case required making several decisions without the assurance of consensus guidelines or published reports detailing successful management of similar patients. The patient's completion of over 15 h of flight time while routinely experiencing 8–9 $+G_z$ without any adverse events suggests soundness of our management. However, close longitudinal follow-up of the patient is required as both continued safety and an adverse event related to his splenic rupture provide key data in managing similar patients. Finally, more published research examining similar patients is needed to more confidently navigate the many decisional junctures described in this case.

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