

One Physician's Unusual Dilemma

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I sat on the sidelines of my son's final soccer match, enjoying the chance to just be a parent. For years, I secretly took a duffel-bag with first-aid supplies "just in case". This time I could relax. I was sitting next to an ED physician- someone more qualified than myself, should the need arise. As I watched, my wife texted: "There's a bird flying in our room." The story quickly evolved: It was a bat flying in the bedroom, now trapped between a butterfly net and oriental carpet. "What now?"

Most recall the board-type of question: "A bat is found in the bedroom- is rabies prophylaxis warranted?" The teaching was "yes" if exposure could not be ruled out. My son had slept in our bedroom the night before. I was trained to follow guidelines, yet the risk seemed ridiculously low. The ED physician admitted "we always treat" based on CDC guidelines if the bat is unavailable for rabies testing. "Bring the bat to the Department of Public Health (DPH) for testing", he suggested.

I returned home, visited the CDC website, and proceeded to get the bat into a plastic container. Wearing thick leather gloves, I heated a nail by candle flame and melted holes into the lid as the site recommended air-holes. I endured the tears and "how can you do this, it's so cute, I'm going to set it free" from my teenage daughter.

Early the next morning, I trudged to DPH, mentioning that I had a bat in the car. "Is it dead or alive? We can't accept live animals", they explained. It was still alive. One employee graciously relieved me of the container and placed it in the freezer, figuring that it would kill the bat. A minute later, another employee handed the container back to me, reaffirming that the bat had to be dead first. I was not prepared for this and wondered aloud if I could tape the air-holes shut or leave it in the hot car for a day. They reminded me, however, that the brain had to be kept intact and cool. After brief deliberation, their consensual recommendation was for me to drown the bat. I was supplied with gloves and two half gallon containers of water, and was directed to the building's bathroom. Not wanting to contaminate a public restroom, I proceeded to purchase a bucket at a hardware store after explaining my predicament. Once in the parking lot, I began the grim job of filling the bucket, only to have the container float; I pushed it down until water slowly entered the air-holes. The next 10 minutes felt like an eternity. Job accomplished, I delivered the waterlogged lifeless bat to DPH. Although I washed my hands longer than the indoctrinated 20 seconds, I couldn't wash away a gnawing feeling inside. As I walked to the car, my daughter texted: "Morning". "Not a good morning", I responded. "Why?" "You don't want to know- don't ask". "I do wanna know". "They don't take live bats- let's leave it at that." "What?! OMG no!"

Shaili Gupta: When Jürgen relayed his story, two questions arose:

1. How many people know when to capture the animal for testing, and why?
2. Who should be responsible for killing the animal and shouldn't there be guidelines on how?

CDC guidelines are clear about indications: If a bite or exposure (of mucosa or open skin to infected saliva, tears or neurologic tissue) cannot be disproven, post-exposure prophylaxis (PEP) is warranted unless the animal tests negative for rabies [1]. The cost of human fatality from lack of PEP far outweighs the cost of testing suspect animals, which is perhaps the least costly of all measures taken for rabies prevention including PEP. Rabies has the highest case fatality rate of all infectious diseases. Of the 56 reported cases between 1995 and 2013, 53 were fatal, 41 were acquired in the US, 37(90%) of which were attributed to bat rabies virus variants [2]. Notably, 25 of these 37 patients didn't report any bite from the bat. Bat bites indeed go unnoticed; some bat-associated rabies viruses can cause infection after inoculation into superficial epidermis e.g. via slight scratch.

CDC website provides step-by-step instructions on 'how to capture a bat for rabies testing' including the provision of air-holes [3]. Perhaps it gives DPH an opportunity to release the bat if they do not find the reported exposure relevant. DPH seems to have been caught in an unforeseen situation and tried their best to help while following guidelines. Review of DPH policies and animal submission forms confirms that submitted specimen can only include the animal's head, with the exception of bats [4]. Rabies among animals is diagnosed by performing the direct fluorescent antibody test (or direct rapid immunohistochemistry test) on a cross section of brainstem and cerebellum. Animals from small bats to large cattle and horses are euthanized and tested annually for rabies. Inclusion of carcass larger than a bat would impose additional burden for hazardous material disposal, infection control and cost. The majority of sample submissions from larger animals are presumably conducted by veterinarians and animal control personnel who can follow personal protection procedures while euthanizing/decapitating the animal. Here, we have a protocol-abiding physician, who despite best intentions, found himself lost and uncomfortable in 'euthanizing' the animal, if drowning can be called that. How would you expect a lay-person to conduct this on-the-spot assignment without compromising their own safety, nor damaging the animal's head?

Bats form the second-largest reservoir of rabies (after raccoons) and have been endemically infected for the last several decades with reports in all 49 continental states [5]. In recent years, emerging infectious

diseases have brought new global focus on bats as a species that harbors more zoonotic viruses than other rodents. In addition to lyssaviruses like Rabies, coronaviruses (SARS, MERS-CoV), henipaviruses (Nipah, Hendra), filoviruses (Ebola, Marburg) have all been isolated from bats, with genomic structures either identical or very closely related to those isolated from humans. Most transmission from bats to humans and other animals is largely from ecological disruption caused by intrusive anthropological activities. Viral coexistence within reservoir hosts like bats could be speculated to have protective roles like immunogenicity against other viruses, bacteria, and even against tumorigenesis. Co-evolution of bats and inherent viral genomes provides for enhanced intrigue in light of many new unanswered questions about the underlying mechanisms. There has been some fascinating insight into the viral and bat genome interface recently, eg the complete elimination of PYHIN genes (that help with formation of inflammasomes) and significant reduction of genes coding for natural killer cell receptors in genomes of two bat species studied [6]. Other pathways of attenuation of innate immune response, like henipavirus interferon antagonism in some bat species, have also been suggested as explanation for bats being such efficient reservoir hosts for various viruses [7]. Certainly, other pathogens continue to be transmitted by bats, histoplasma, salmonella, yersinia, pasteurilla, influenza virus, paramyxoviruses, being only a few of them.

What would I do if I found a bat in the bedroom my child slept in? I would do what Jürgen did: capture the bat and bring it to DPH. I'm

not sure about the steps thereafter. I would need instructions. In fact, I would need someone to relieve me of my captive and figure out the rest themselves.

PS: Jürgen's bat tested negative for rabies and prevented unnecessary expenditures of risk-exposure evaluations and prophylaxis.

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