

# Invited Editorial

## Crossroad between camel bites and crocodile bites

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I read with interest the recent BBC article published on 4th February describing the story of a villager who faced a giant crocodile and killed it as a revenge for his pregnant wife.<sup>1</sup> The pregnant woman was dragged down underwater from the river's edge of Lake Kyoga of Uganda by the huge crocodile and then completely disappeared. The dead animal was taken to Makerere University in Kampala, where it had a postmortem. It was more than 4 meters long and weighed about 600 kilograms.

This story reminded me of a patient whom we have treated, almost 15 years ago, immediately after joining my new job in Al-Ain Hospital, United Arab Emirates. The patient was bitten in the neck by an aggressive camel causing carotid artery injury and brain infarction. The patient died few days later.<sup>2</sup> I was surprised to observe how trivial the marks of the camel bites were, despite causing serious injuries. The literature on camel bites and their behavior was so scarce at that time, simply because these injuries occurred in developing countries. It took our Research Group a journey of almost 15 years by interviewing patients, collecting data on camel bite wounds, studying the jaw of the camel, and correlating it with internal injuries so as to understand the mechanism of injury of camel bites and how to prevent them.<sup>1,3,4</sup> The most difficult part for us was to study the behavior of the camel. I was surprised to find

how much scarce knowledge on camel behavior was in the medical literature compared with the knowledge of the local people who lived years and years with camels and observed their behavior.

The moment I read that story on the BBC website<sup>1</sup>, I entered directly to the MEDLINE and searched the general term of "Crocodile bite". There were only 48 citations. Going through the abstracts, I found that there were 16 articles from USA, six from Australia, and only nine from Africa, and none was from Uganda. Nevertheless, searching the Google, I found another rich source of information, The Worldwide Crocodilian Attack Database<sup>5</sup> which permits retrieval of data from the website for research purposes if acknowledged.<sup>5</sup> There were 69 reported cases that had Nile crocodile bites from Uganda. I have retrieved their data, entered them into PASW Statistics 21 Program to analyze them (SPSS Inc, USA). The victims had a mean (range) age of 26 (4-50) years. Forty six (66.7%) were males, 20 (29%) were females and three were of unknown gender (4.3%). Sixty three of these patients died (91.3%). Uganda had the twelfth rank between countries on the number of cases entered into the database (69/2777, 2.5%).

The Nile crocodile has a reputation of being the biggest killer of humans in Africa because it is widely distributed and shares humans with the same water resources.<sup>6,7</sup> In a report from Korogwe District, Tanzania, 51 patients were killed by crocodile bites over a period of 5 years (1990-1994) in a catchment area of about 200 000 population.<sup>8</sup> This gives a calculated annual mortality rate of 5/100 000 which is more than the recent reported motor vehicle collision death rates in UK or Sweden.<sup>9</sup>

Crocodiles have a high bite force capable of transecting the body of an adult human into two parts or amputating the lower limb above the knee.<sup>7</sup> This is very similar

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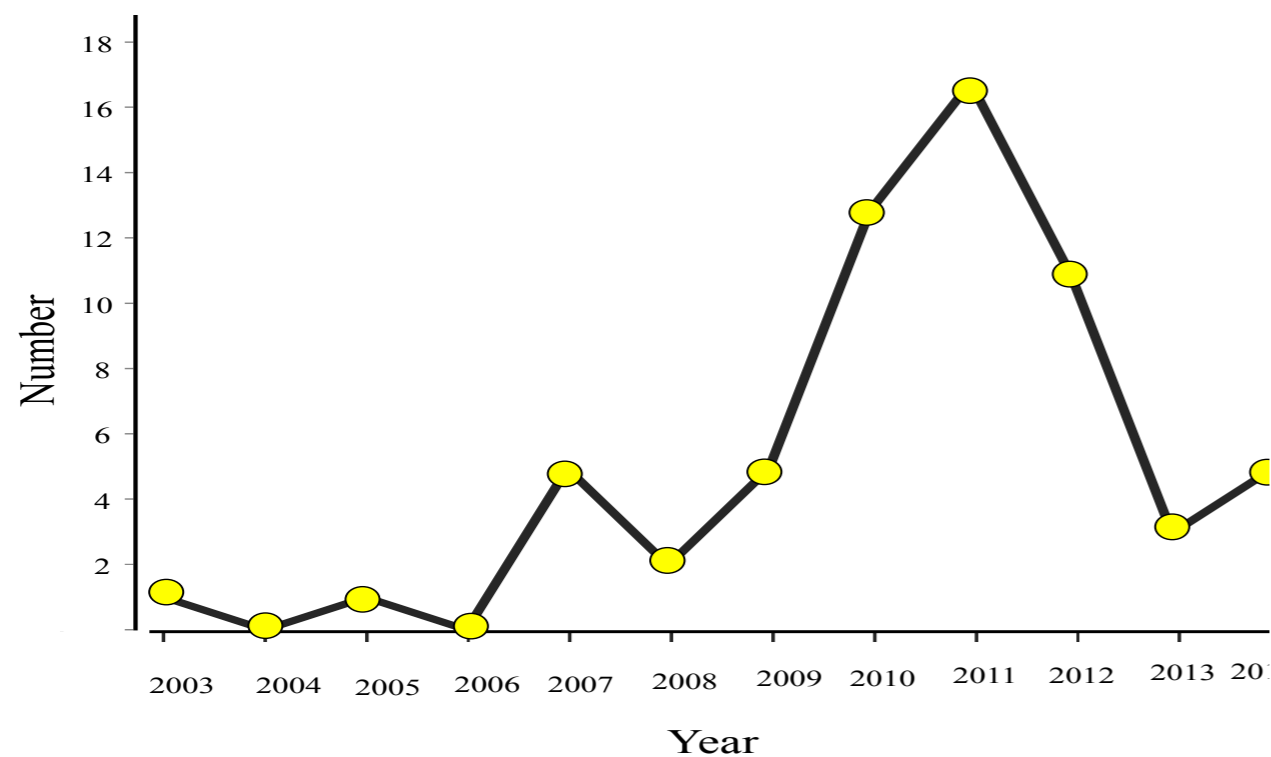
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to mutilated war blast injuries. In water, humans are weaker and slower than other prey animals, have difficulty to balance their body, and are easier to be hunted.<sup>6</sup> That is why majority of crocodile attacks occur in water or a near water edge.<sup>7,8,10</sup>

Most properly, the presented data (Fig 1) underestimates the real size of the problem. Majority of minor injuries may not have been reported at all because they occur in remote areas. Furthermore, the cause of death may be unknown for those who disappeared. According to an Ugandan Wildlife Authority official, there are about 30

Ugandans killed every year by crocodiles.<sup>11</sup> The demography of the reported patients are similar to those in other parts of the world, majority being young males.<sup>7</sup> A mortality of 90% is higher than the reported mortality of Nile crocodile bites in the medical literature which is around 65%.<sup>7</sup> There was most probably a selection bias in the reported data. In contrast, camels caused more than 80% of animal-related injuries in our city<sup>12</sup>, 25% of them were bites.<sup>13</sup> The estimated incidence of camel bite injuries requiring hospitalization in our city was 1.5 per 100,000 inhabitants. Despite that, mortality was only 3%.<sup>3</sup>

**Figure 1:** Human fatality caused by Nile crocodile bites in Uganda as reported by The Worldwide Crocodilian Attack Database<sup>5</sup>, 2003-2014, (n=62).



We have learned overtime that it is essential to apply the principles of prevention to reduce camel-related injuries. We found that adopting the Haddon matrix is very useful. It gives a scheme for preventing the attack before it occurs, reducing the impact of the attack, and having proper post-attack medical care. We consider humans as the host, animals as the vector and both are living within the same environment.<sup>14</sup>

Understanding animal anatomy, behavior, biomechanism of injury, and training workers on dealing with an-

imals can reduce the severity of injury. The mechanism of camel and crocodile bites are complex, including penetrating, crushing, and blunt trauma.<sup>3,7</sup> The crocodile usually suddenly jumps from underwater, quickly grabs the victim by its strong teeth, shakes him/her, strongly, rolls the body of the victim over swiftly, and finally merges underwater with the victim.<sup>7,14</sup> In contrast, the camel may lift the victim up by its canine teeth, crushes the body by the jaw, and throws the victim away to hit the ground, and may even later step on the patient.<sup>1,3,4,15</sup> Using a muzzle to cover the camel mouth can prevent bite injuries before they occur.<sup>3</sup>

Nile crocodile bites are more common during the hot season when the crocodiles are more active and grow quicker, the level of water is low, and the density of crocodiles and their water preys are high.<sup>6</sup> In contrast, camel bites are more common during the cold rutting season (November and March), during which the sexually active male camel becomes irritable and difficult to handle. It is recognized by its pink throat diverticulum protruding from its mouth, covered by froth, and reaching up to 25 cm long. This is an indication that this is a dangerous camel that should be avoided.<sup>3,4</sup> Interestingly, camel care givers in our community<sup>3</sup> and local inhabitants of Australia and Africa.<sup>4,10,14</sup> knew that the best way to reduce the injury severity during the bite is to attack the animal by poking its eyes by the fingers of the victim so that it opens its mouth and leaves the victim.

Changing the environment to be suitable for both humans and crocodiles should be well thought. The methods to do that can be best answered by the local people who are aware of their own circumstances. Fresh water supply or fishing locations can be arranged so that crocodiles and humans are relatively isolated.<sup>6</sup> There are no ready solutions for these problems. Every community should be innovative in its local solutions by following simple principles of injury prevention.

Education is another important preventive measure which is more difficult to achieve. Education of the local inhabitants should address their local beliefs. Attacks on human victims by crocodiles are often ascribed to witchcraft by some communities. Villagers may not attempt to save the victim because they think that if they kill a crocodile, their son may be eaten by another one.<sup>8</sup>

Finally, legislation played a very important role in preventing camel-related injuries in our community.<sup>16</sup> Similarly reducing the number of crocodiles, re-allocating them, or protecting them by law should be well-thought and built on evidence using a systematic approach balancing the benefit against harm and not on emotional instantaneous moments.

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