Special Articles

Computer Based Program for Rapid Canine Rabies Diagnosis

Boonlert Lumlertdacha, DVM*, Sippakarn Kassawat, MSc**,
Veera Thepsumethanon, DVM*, Thiravat Hemachudha, MD***

** Queen Saovabha Memorial Institute, Thai Red Cross Society*
*** Faculty of Commercial and Management, Prince of Songkla University, Trang*
**** Medical Faculty, Chulalongkorn University*

Rabies post exposure treatment and rapid diagnosis in an endemic area requires skillful and an experienced medical staff and veterinary specialists. A software program was introduced in 2000 as a tool to diagnose rabies based on clinical symptoms and signs of suspicious dogs where veterinarian service and other laboratory diagnostic options are not immediately available. It is easily accessed from the website: www.soonak.com/rabies.

Keywords: *Rabies, Canine, Diagnosis, Computer, Thailand*

J Med Assoc Thai 2005; 88(8): 1144-6
Full text. e-Journal: *http://www.medassocthai.org/journal*

Direct fluorescent antibody assay (DFA) on brain impression smear is the gold standard test for post mortem rabies diagnosis in dogs, humans, and other animals[1], however, this technique may not be practical in many areas where laboratory facilities are unavailable or euthanasia is denied due to cultural and religion beliefs. Previous study showed that all proven rabid dogs and cats died spontaneously within 10 days[2]. Observation of dog for 10 days by a veterinary specialist is another option, however, appropriate post exposure prophylaxis (PEP) must be given with no delay as recommended by the World Health Organization[3].

A computer based software program was developed in 2000 by Sippakarn Kassawat as part of his master degree thesis[4] in Technology of Information System Management. The idea for the development was based on the original concept detailed in: "Expert System for the Technical Professional"[5]. The program was written with Microsoft Visual Basic 6.0 and Access 97. This interactive software has user friendly interface and is applicable for all users. It was designed to act as a primary consultant for any individual who has contacted with suspicious rabid dogand who could get access the use of computer and internet.

The program can be found at the website; www.soonak.com/rabies.

This program was developed based on an analysis of the clinical records of 1,523 dogs maintained under quarantine for screening of rabies at the rabies quarantine unit of Queen Saovabha Memorial Institute (QSMI) from 1989-1999. Observation of each clinical sign of these dogs were recorded. Those that died during the quarantine were considered rabies positive only when the DFA result was positive. Dogs that survived the 10 days of observation with no clinical signs of illness and those found negative by DFA were judged rabies negative. Frequency of clinical signs found in the rabies positive group had been scored and weighted upon that of the rabid group, whereas the signs shown in the rabies negative group described the negative chance. These negative influences helped differentiating rabies from other disorders. The critical signs differentiating rabies from other neurological disorders, such as canine distemper, hypocalcemia and other neurologic disorders, included severe acute behavioral changes, over aggression, restlessness, dropping jaws, loss of body control and ability to intake food and water, and posterior limbs paresis.

Correspondence to : Lumlertdacha B, Queen Saovabha Memorial Institute, Thai Red Cross Society, Rama 4 Rd, Bangkok 10330, Thailand. Phone: 0-2252-0161 ext 127, Fax: 0-2254-0212, E-mail:Qsmibld@yahoo.com

Bay's Probability Theory used in this calculation which described as "the possibility of any event is able to be measured by personal belief towards the possibility of such event, thus it is not necessary to repeat causes and measure frequency of occurrence"[6]. The probability (P) of a hypothesis (H) is represented by P [H] expressing the real number between 0 and 1, which is used in measurable mean of the hypothesis (H) belief. The conditional probability of hypothesis or P [H|E] is the possibility of hypothesis (H) after having evidence (E). Therefore, in relevance to the expert's experience and personal belief, it is appropriate to apply the Bay's Probability in the system. Theory in the backward chaining method is under an uncertainty condition.

$$P[H_k|E] = P[H_k]\,P[E|H_k] / \sum_{i=0}^{n} P[H_i]\,P[E|H_i]$$

Users will be asked to answer all the queries about the signs of the suspicious dogs with "yes" or "no" as described in Table 1. The program will score and analyze the probable chance and display the percentage of risk to be rabies in 5 ranges as follows and with the medical recommendation for the exposed individual.

0-20	percent - no risk of rabies
21-40	percent - minimal risk of rabies infection or sub-clinical rabies
41-60	percent - possible rabies
61-80	percent - probable rabies
81-100	percent - highly likely to be rabies

Dog owners or exposed patients can easily access this program from the website whenever there is concern about rabies. This program should be useful for screening suspicious rabid dogs. This software has been integrated into the daily operations of rabies diagnostic and quarantine facility of QSMI in order to follow the dynamic stages of the disease throughout Thailand. Assessment of the program has been done periodically in order to assure its accuracy. It remains to be proven whether this can be applicable in other areas where there may be more variations in clinical expressions of rabies in dogs due to differences in virus strains and where other neurotropic viruses coexist. However, with further investigation and upgrades, this program may offer an alternative way to diagnose rabies in regions that cannot afford state of the art diagnostic facilities.

Table 1. Questionnaire for clinical signs

1. Extensive aggression, bite at man and animal(s)
2. Hyper excitation, running around
3. Anxiety
4. Bite the cage or chain aggressively, if captive
5. Obvious change of behavior
6. Anorexia, acute
7. Hyper thermia
8. Acute severe conjunctivitis
9. Inability to control tongue, dropping tongue out of the mouth
10. Inability to hold the mandibles, dropping jaws
11. Severe congestion on tongue, signs of trauma
12. Hoarse sound when barking
13. Paresis signs of muscles around the neck, hard to swallow food and water
14. Continuous vomiting or signs of regurgitation
15. Pupillary dilation
16. Hides in a dark corner
17. Inability to open eyes in the light
18. Lost the ability to control body movement
19. Weakness of hind limbs, muscle tremor, unable to walk on attempts
20. Attacking to all moving objects, aggressively bites
21. Being a milking bitch, given birth less than 3 months
22. Being a milking bitch of more than 5 puppies
23. Running around without direction, hard to control direction
24. Pustule nodules on the skin around the abdominal area
25. Thickening of pads, peeling of the pad layers
26. Loss of visual ability, cataract-like eyes
27. Purulent mucus of nose and eyes

Acknowledgements

The authors wish to thank the staff of the diagnostic and quarantine rabies unit, Queen Saovabha Memorial Institute for the information record. This research was supported in part by The Japan Health Sciences Foundation and National Center for Genetic Engineering and Biotechnology (Thailand).

References

1. Hemachudha T, Laothamatas J, Rupprecht CE. Human rabies: a disease of complex neuropathogenetic mechanisms and diagnostic challenges. Lancet. Neurol 2002; 1: 101-9.
2. Tepsumethanon V, Lumlertdacha B, Mitmoonpitak C, Sitprija V, Meslin FX, Wilde H. Survival of naturally infected rabid dogs and cats. CID 2004; 39: 278-80.

3. World Health Organization, 1992. WHO expert committee on rabies. WHO technical report series 824.
4. The Expert System for Rabies Diagnosis in Dogs, ISBN 974-04-2200-4, Mahidol University, Thailand.
5. Wolfgram DD, Dear TJ, Galbraith C. Expert systems for the technical professional. Introduction to expert systems 1987; 1: 15 - 22.
6. Jarrett J, Kraet A. Statistical Analysis for Decision Making. Probability 1989; 1: 75-83.

การวินิจฉัยอาการโรคพิษสุนัขบ้าด้วยโปรแกรมคอมพิวเตอร์

บุญเลิศ ล้ำเลิศเดชา, สิปปกานต์ กลัดสวัสดิ์, วีระ เทพสุเมธานนท์, ธีระวัฒน์ เหมะจุฑา

การให้การรักษาผู้สัมผัสโรคพิษสุนัขบ้าและการวินิจฉัยสัตว์ป่วยในเขตที่มีการระบาดของโรคเป็นงานที่อาศัยบุคคลากร ทางการแพทย์และสัตวแพทย์ผู้เชี่ยวชาญพิเศษที่มีความชำนาญและมีประสบการณ์โปรแกรมคอมพิวเตอร์สำเร็จรูปที่ใช้ในการวินิจฉัยอาการโรคพิษสุนัขบ้าได้ถูกเขียนขึ้นในปี ค.ศ. 2000 เพื่อใช้เป็นเครื่องมือเบื้องต้นในการวินิจฉัยสัตว์ที่สงสัยโดยเฉพาะในพื้นที่ที่ไม่มีสัตวแพทย์ให้คำปรึกษา โปรแกรมนี้สามารถเข้าไปใช้ได้จากเวบไซท์ www.soonak.com/rabies โดยไม่คิดมูลค่า ที่ส่วนท้ายของการใช้โปรแกรม จะให้คำวินิจฉัยและคำแนะนำแก่ผู้ที่สัมผัสและเกี่ยวข้องในการป้องกันตนเองจากโรคพิษสุนัขบ้า