暴露前疫苗使用實務
及人類狂犬病臨床診治

高雄榮民總醫院
感染科&加護醫學內科
陳瑞光 醫師

個案報告

General Data

- Name：X X
- Sex：Male
- Age：30 y/o
- Occupation：汽車零件工
- Chart Number：1xxxx101
- Address：菲律賓
- Admission date：102/05/10

Chief Complaint

- 高燒及意識不清一天

Presented Illness

- 病人表哥平時和病人同住同吃，一起到台灣工作
- **3/10(2個月前)**

  病人在菲律賓晚上上廁所時被一隻瘋狗追咬至家中，被狗咬傷大腿和前臂，之後這隻狗被其他家屬宰殺吃掉患者
- **4/7(1個月前)** 至台灣屏東擔任汽車零件工
- **5/3 ~ 5/4(1周前)**

  右臂、右肩、右臀部肌內痠麻、疼痛，到診所吃藥沒有改善
- 5/5(6天前)

  晚上症狀持續沒有改善，去屏東醫院，會噁心嘔吐，吞嚥困難

Presented Illness

- **5/6(5天前)**

  出現輕微的神智異常，說話邏輯異常(似吸毒患者)、喝水困難
- **5/7(4天前)**

  食不下嚥，和仲介聯絡想要回家
- **5/8(3天前)**

  吞嚥情形稍微改善可以開始吃飯，但吃飯時有手抖現象
- **5/9(2天前)**

  走路姿勢異常，小碎步，因非常虛弱，至高榮急診室

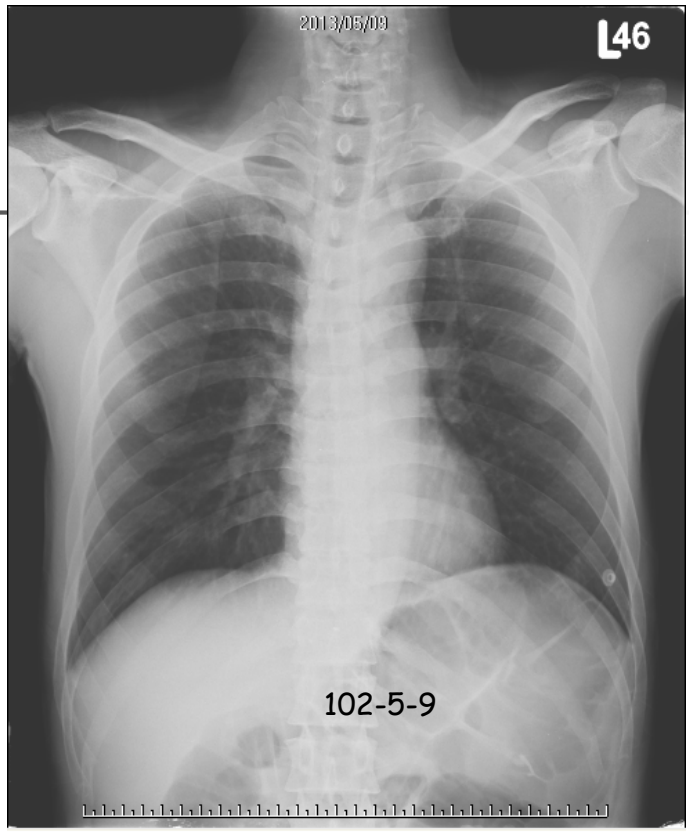
ER and ward (5/9)

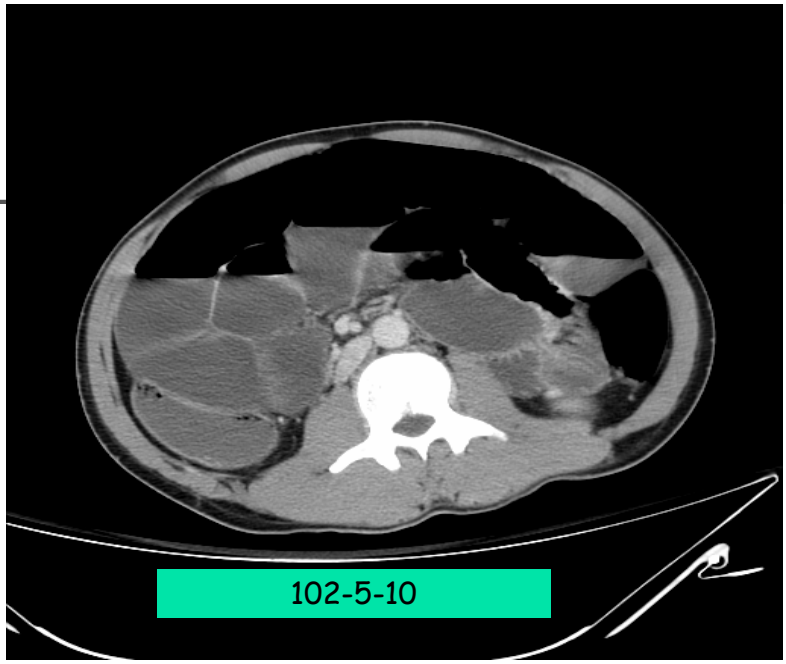
- Consciousness：E4V4M5
- Vital Sign: T/P/R 38.8/148/20, BP 114/98 mmHg
- Eye：no icteric sclera, no pale conj. upper gaze
- HEENT: JVE (-), supple, salivation
- Chest：bilateral coarse breathing sound
- Abdominal：hypoactive bowel sound
  no tenderness, no rebounding pain
- Extremities：no pitting edema, muscle
  fasciculation

致命的咬痕

LAB DATA (05/09)

	WBC	HGB g%	HCT %	MCV	RDW	PLT	Band	Seg	Lym	Mo
5/9	18340	18.6	54.1	65.2	16.0	210	1	79	15	5
	Na	**K**	**BUN**	**Cr.**	**GPT**	**GoT**	**T.Bili**	**CK**	**MB**	**TrI**
5/9	158	3.7	70	3.24	46	129	2.5	6234	188	2.8
5/10	165	4.0	41	1.86	34	93	1.4	5494	162	7.1
	PH	**PCO2**	**PO2**	**HCO3**	**BE**	**Sat O2**				
5/9	7.474	22.9	83	17	-3.9	97				





- Diffusely dilated bowel loops in the abdomen are noted with much bowel gas and fluid retention, including large and small bowels without apparent transition zone detection.

No definite abnormal rim-enhancing mass or abscess lesion in the brain noted.

CSF data(5/11)

OP (mmH2O)	WBC Cumm	N/L	RBC Cumm	Protein Mg/dl	Sugar Mg/dl	Lac mmol/dl	Cl Mg/dl
200	12	/100	1	32	110	2.32	144

- Cryptococcus Ag (-)
- Pneumococcal Ag(-)

Algorithm for Differential Diagnosis of Rabies

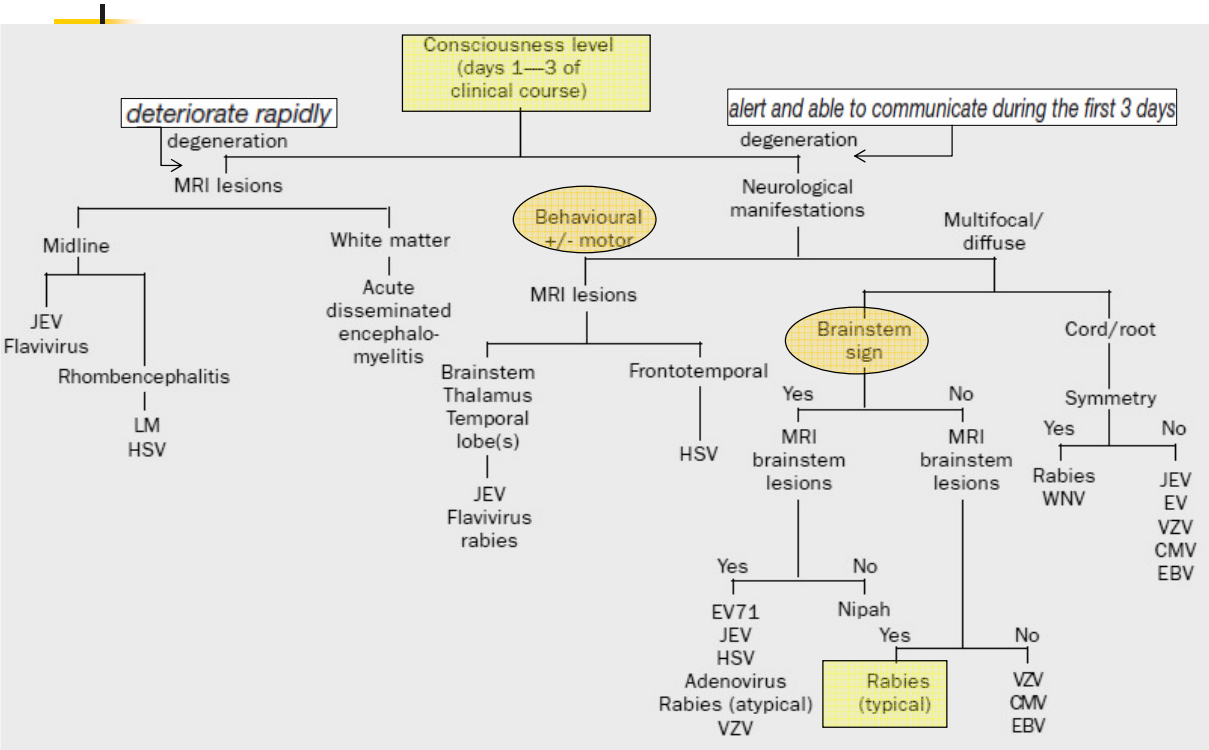


Table 5 Non-viral causes of infectious encephalitis

Bacterial
Mycobacterium tuberculosis
Mycoplasma pneumoniae
Listeria monocytogenes
Borrelia burgdorferi
Leptospirosis
Brucellosis
Leptospirosis
Legionella
Tropheryma whippeli (Whipple's disease)
Nocardia actinomyces
Treponema pallidum
Salmonella typhi
All causes of pyogenic meningitis
Rickettsial
Rickettsia rickettsia (Rocky Mountain spotted fever)
Rickettsia typhi (endemic typhus)
Rickettsia prowazeki (epidemic typhus)
Coxiella burnetti (Q fever)
Ehrlichiosis (*Ehrlichia chaffeensis*—human monocytic ehrlichiosis)
Fungal
Cryptococcus
Aspergillosis
Candidiasis
Coccidiomycosis
Histoplasmosis
North American blastomycosis
Parasitic
Human African trypanosomiasis (sleeping sickness)
Cerebral malaria
Toxoplasma gondii
Echinococcus granulosus
Schistosomiasis

Modified from Chaudhuri and Kennedy,[9] with permission.

TABLE 87-3 Possible Etiologic Agents of Encephalitis Based on Epidemiology and Risk Factors

Epidemiology or Risk Factor	*Possible Infectious Agents*
Travel	
Central and South America	Rabies virus; eastern equine encephalitis virus; western equine encephalitis virus; Venezuelan equine encephalitis virus; St. Louis encephalitis virus; Rocio virus
Australia	Murray Valley encephalitis virus; Japanese encephalitis virus; Hendra virus
Southeast Asia, China	Japanese encephalitis virus; tick-borne encephalitis; Nipah virus; Me Tri virus; Semliki Forest virus
India, Nepal	Rabies virus; Japanese encephalitis virus; Chikungunya virus
Africa	Rabies virus; WNV; Rift Valley fever virus
Middle East	WNV
Europe	WNV; tick-borne encephalitis; louping ill virus; Toscana virus
Russia	Tick-borne encephalitis; Powassan virus
Insect contact	
Mosquitoes	Eastern equine encephalitis virus; western equine encephalitis virus; Venezuelan equine encephalitis virus; St. Louis encephalitis virus; Murray Valley encephalitis virus; Japanese encephalitis virus; WNV; California encephalitis group; Chikungunya virus; Me Tri virus
Ticks	Tick-borne encephalitis; Powassan virus; louping ill virus
Animal contact	
Old World monkeys	Herpesvirus B
Birds	WNV; eastern equine encephalitis virus; western equine encephalitis virus; Venezuelan equine encephalitis virus; St. Louis encephalitis virus; Murray Valley encephalitis virus; Japanese encephalitis virus
Rodents	Eastern equine encephalitis virus (South America); Venezuelan equine encephalitis virus; tick-borne encephalitis; Powassan virus (woodchucks); La Crosse virus (chipmunks and squirrels); LCMV; monkeypox
Horses	Eastern equine encephalitis virus; western equine encephalitis virus; Venezuelan equine encephalitis virus; Hendra virus
Swine	Japanese encephalitis virus; Nipah virus
Dogs	Rabies virus
Bats	Rabies virus; Nipah virus
Raccoons	Rabies virus
Skunks	Rabies virus
Sheep and goats	Louping ill virus
Person-to-person transmission	HSV (neonatal); VZV; Venezuelan equine encephalitis virus (rare); poliovirus; enteroviruses; measles virus; mumps virus; rubella virus; EBV; HHV-6; herpesvirus B; WNV (transfusion, transplantation, breast-feeding); HIV; rabies virus (transplantation); influenza virus
Season	
Late summer/early fall	All agents transmitted by mosquitoes and ticks (see above); enteroviruses
Winter	Influenza virus; LCMV
Recreational activities	
Sexual contact	HIV
Swimming	Enteroviruses
Camping/hunting	All agents transmitted by mosquitoes and ticks (see above)
Spelunking	Rabies virus
Occupation	
Physicians and health care workers	VZV; HIV; influenza virus
Veterinarians	Rabies virus
Laboratory workers	WNV; HIV
Workers exposed to Old World primates	Herpesvirus B
Workers exposed to horses	Hendra virus
Unvaccinated	VZV; Japanese encephalitis virus; poliovirus; measles virus; mumps virus; rubella virus
Recent vaccination	ADEM
Ingestions	
Unpasteurized milk	Tick-borne encephalitis
Transfusion and transplantation	CMV; EBV; WNV; HIV; tick-borne encephalitis virus; rabies virus; LCMV
Immunocompromised	VZV; CMV; HHV-6; WNV; HIV; JC virus
Agammaglobulinemia	Enteroviruses
Age	
Neonates	HSV-2; CMV; rubella virus
Infants and children	Eastern equine encephalitis virus; Murray Valley encephalitis virus (rapid in infants); influenza virus; La Crosse virus
Elderly	Eastern equine encephalitis virus; St. Louis encephalitis virus; WNV

Impression

- R/I Atypical infection with rhambdomyolysis, acute kidney injury and liver function impairment, DDx = leptosprosis, Rickettsia disease, Rabies virus infection

Plan to Do

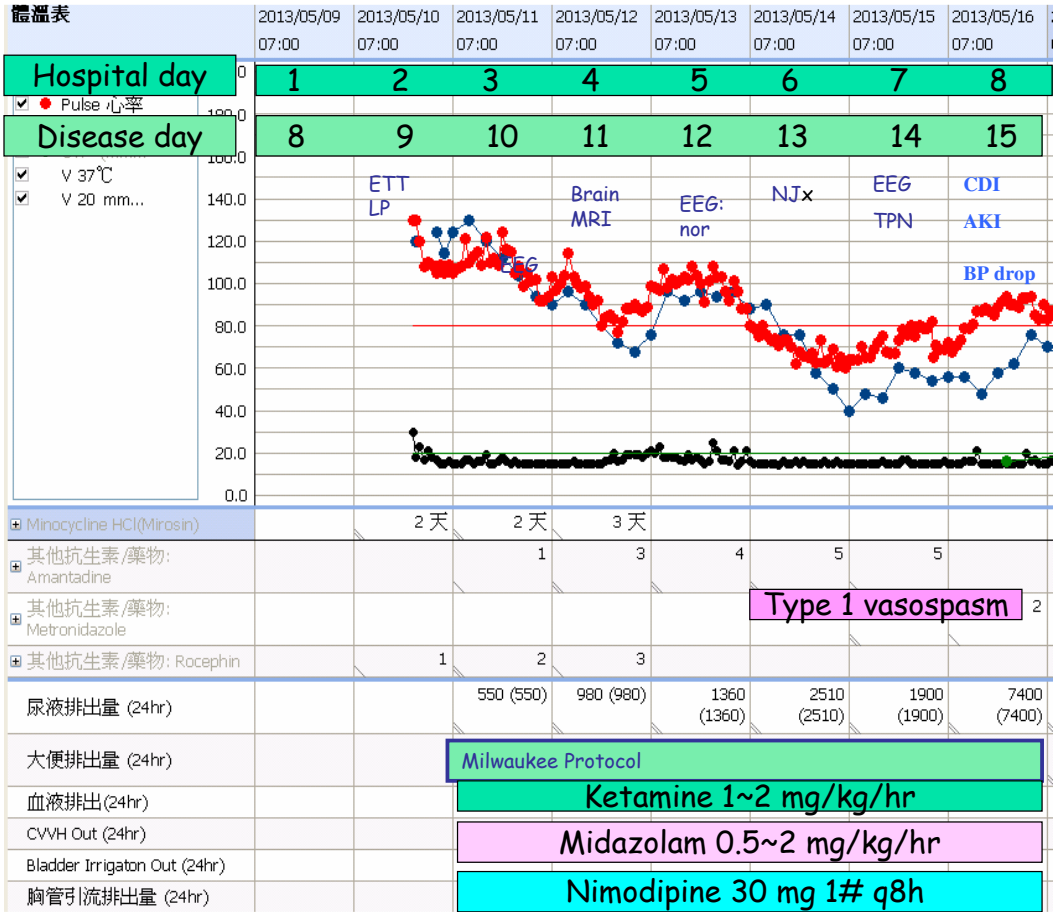
- Minocycline + Ceftriaxone
- Fluid challenge
- 通報 Leptosprosis, Rickettsia disease & Rabies

Hospital course (102/05/10~)

5/10 ICU

觀察病人有畏光、畏聲、畏風症狀、極易受到外界刺激、牙關緊閉、口水多、表情十分驚恐，不停水瀉，Light reflex (+/+)，剛入加護病房時喊他名字尚有反應，之後為保護呼吸道插管，並使用鎮定劑

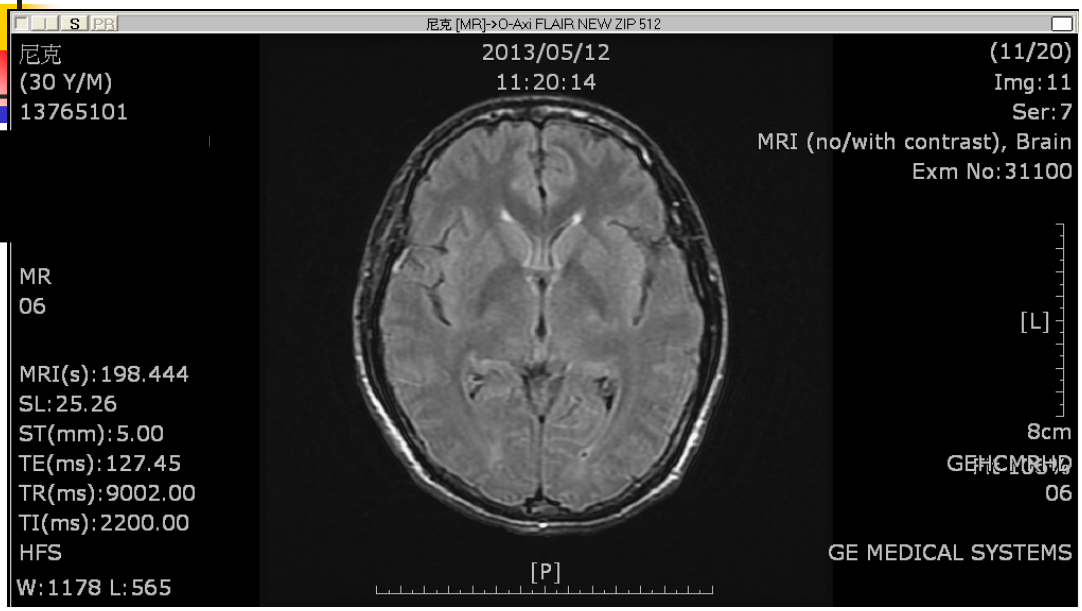
aerophobia | hydrophobia | grimace | trismus



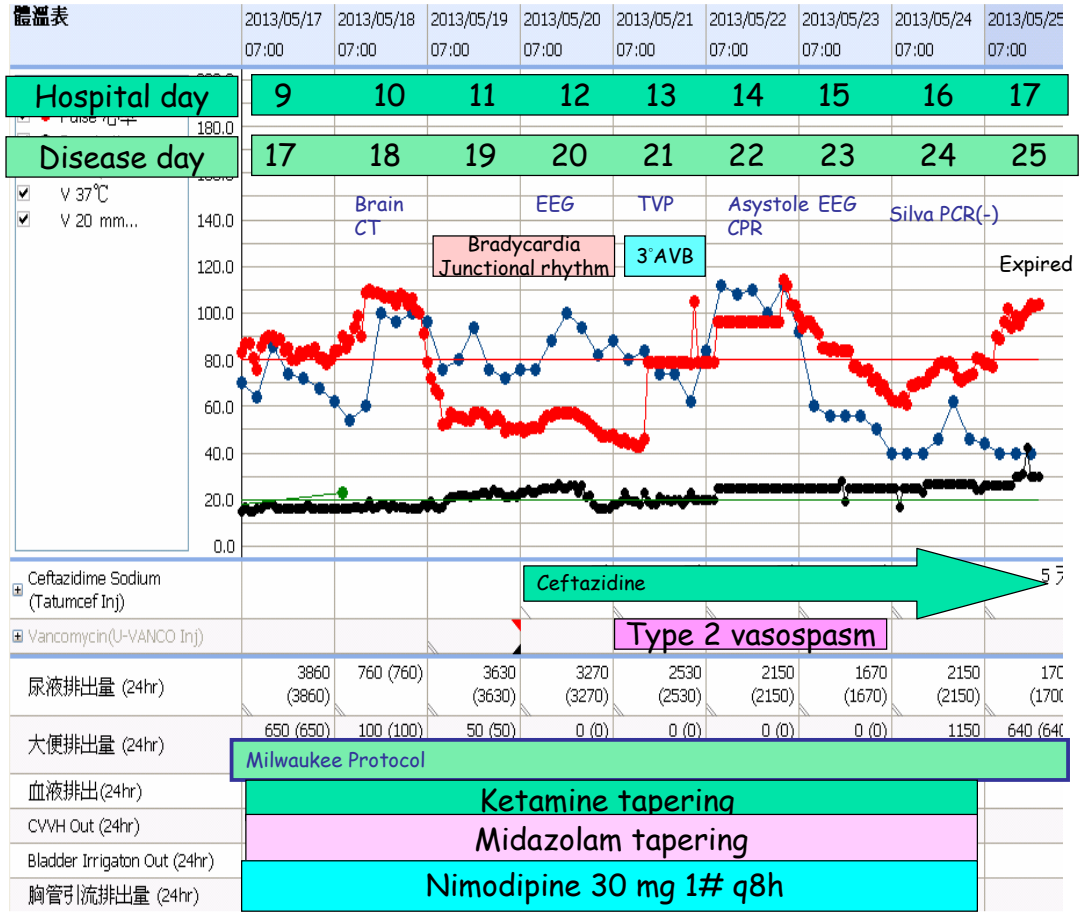
EEG findings

- 5/13(HP day 5): normal EEG
- 5/15 (HP day 7): Intermittent slowing, focal, theta, <u>left fronto-temporal region</u>.

0512 Brain MRI



- Brainstem: an ill-defined mild hyperintense lesion in central pons on FLAIR and post-contrast T1WI, measured about 1 cm in maximal diameter. Rhombencephalitis suspected



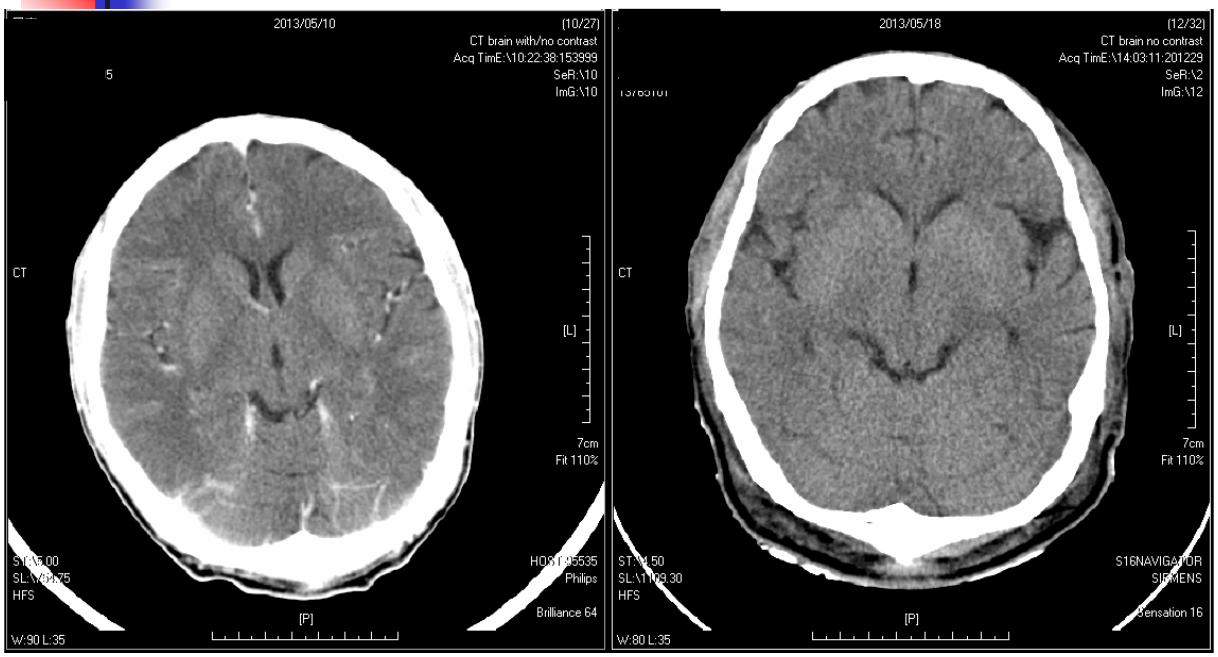
EEG findings

- 5/20 (HP day 12): Intermittent slowing, focal, delta and theta, <u>bilateral fronto-temporal region . Diffuse background slowing.</u>
- 5/23 (HP day 15):<u>Diffuse background slowing, severe, diffuse</u> .Posterior background: 2-3 Hz.

Cause of death

Diffuse cerebral dysfunction

0518 Brain CT



0510 0518

狂犬病介紹

Epidemiology

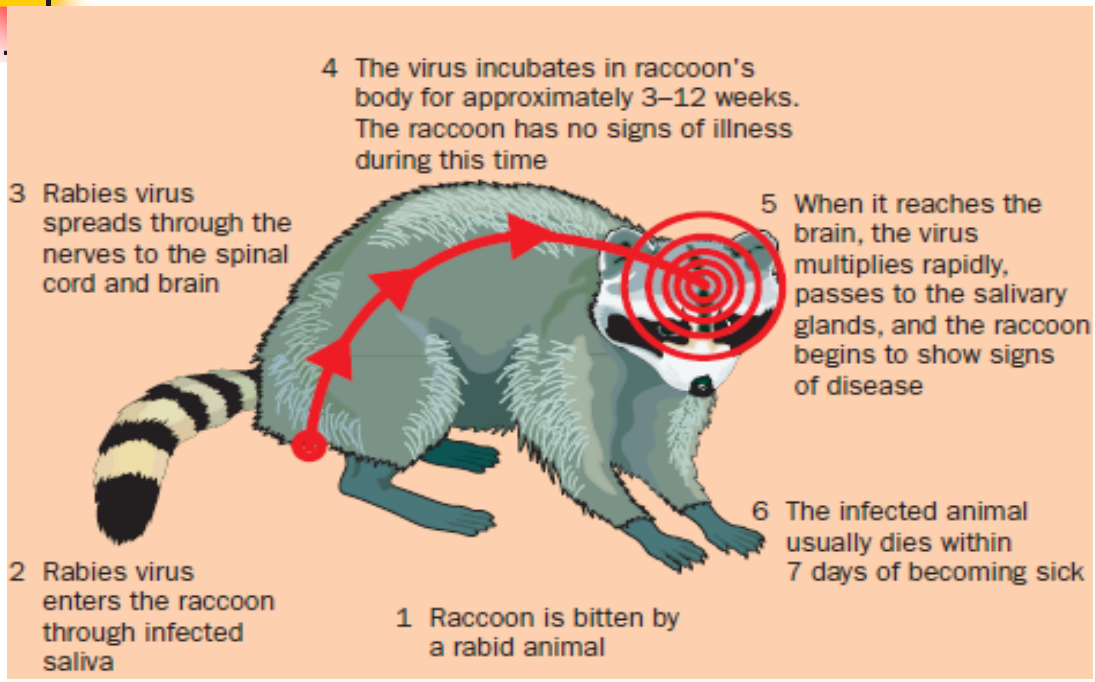
- WHO estimated die of Rabies
  - 55000 death per year, 31000 in Asia, 24000 in Africa
- In Taiwan
  - No human case since 1959 (3 cases imported from endemic area in 2002 & 2012 & 2013)
  - No animal rabies case since 1961
- Geographic distribution
  - Worldwide distribution, <u>except</u> in Antarctica, New Zealand, Japan, Taiwan, Sweden, Norway, Spain

Mammalian Rabies Reservoir and Vectors

Animal rabies epidemiology

- 狗、貓還是主要狂犬病來源
- ✓ U.S：整體而言，逐年下降 (scheduled vaccination)，根據區域不同比例不同。另外蝙蝠在美國是除了狗之外的一個重要來源。
- ✓ Taiwan：台灣的狗沒有狂犬病
- 野生溫血動物：也有可能感染狂犬病毒，eg.racoons (浣熊)，skunks (臭鼬)，foxes (狐) & coyotes (狼) ➔ vaccination 與否端看是否可捕捉到動物進行 rabies 檢驗以及 exposure type
- Rodent (囓齒動物)：看種類，大型囓齒動物(旱獺或河狸)會感染 racoon rabies，但是小型囓齒動物不會感染 rabies virus

Productive Pathogenesis of Animal Rabies

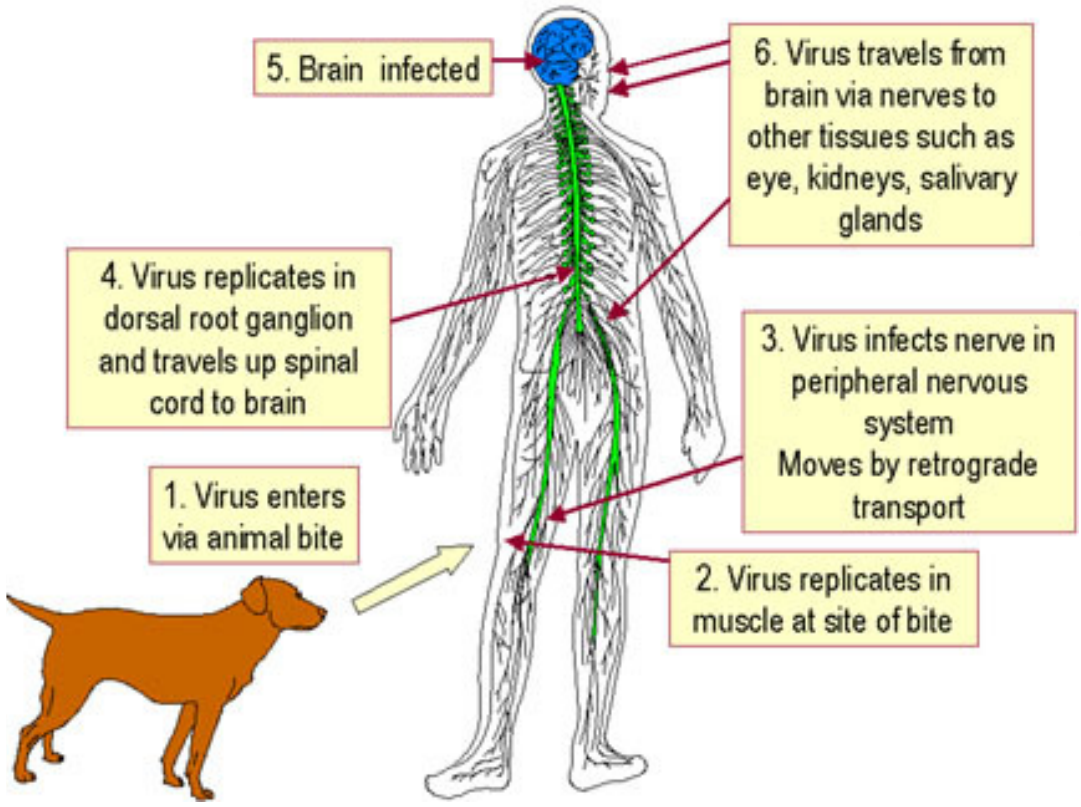


Transmission

- **Transmission**
  - **Exposure to saliva from an animal bite**
  - **Organ transplantation (including liver, kidney, arterial segment, corneal transplant)**
- **Incubation period**
  - **3 ~ 8 weeks (range from 7 days to 9 years)**
  - **Shorter period: rich innervated area (ex: face), distance to brain, cloth protection, viral load**

Viral tropism & dissemination (Pathogenesis)

- Local inoculation → Migrate from peripheral to central retrograde (**5-10cm/day**) → Reach **dorsal root ganglia** of the spinal cord → Ascending rapidly up to the spinal cord to the brain (**diencephalon, hippocampus & brainstem**)
- **Spread along somatic and autonomic nerves** → dissemination
- Highly innervated area (eg.sliva glands)：productive viral replication and shedding



圖片來源: University of South Carolina School of Medicine

可傳染期

- 狗或貓：自臨床症狀前3~7天開始至整個病程中都維持著傳染力。
- 其他動物：
  - 蝙蝠在臨床症狀前12天，即可分泌病毒。
  - 鼬鼠(skunk)在臨床症狀前8天，即可分泌病毒
- 人感染狂犬病之可傳染期則尚未清楚，但若仍可由唾液檢出狂犬病毒，應視為有傳染力。

Control of Communicable Diseases Manual 19th ed

感受性及抵抗力

- 幾乎所有的哺乳類動物都有感受性，但與病毒株別有關。
- 人類可能較其他動物不易受到狂犬病感染，在伊朗的研究顯示，人類被狂犬病動物咬傷，未經治療的情況下，約有40%發生疾病。

Control of Communicable Diseases Manual 19th ed

Host susceptibility to infection

- All mammals are believed susceptibile to rabies
- ✓ Infected variant (施暴的動物)
- ✓ Size of the inoculum (動物唾液污染程度)
- ✓ Degree of the bite site (咬傷的程度及面積)
- ✓ Exposed area (eg.face & head) (暴露位置)
- ✓ Host immunity and genetics

Clinical Rabies

Clinical Presentation

- **Prodromal symptoms**
  - **Low grade fever, chills, malaise, weakness, sore throat, nausea, vomiting, anorexia**
  - **Paresthesias, pain, tenderness, tingling over bite site**
  - **Lasted from few days to one week, and progression to clinical rabies later**

Clinical rabies

Encephalitic (furious) rabies (80%)

- **General**：hyperexcitability (restlesness, agitation), fluciating cons, 視聽幻覺, 言行暴力傾向
- **Hydrophobia** (induced pharyngeal spasm) (30-50%)
- **Aerophobia** (induced pharyngeal spasm) (9%)
- **Muscle spasm** (face, pharyngeal, neck, back, diaphragm),
- **Autonomic instablity** (25%)：overactivity of autonomic system → hyersalivation, lacrimation, sweating, “goose flesh”, pupil dilatation, hyperpyrexia alternated hypothermia, cardiac arrhythmia

Clinical rabies

Encephalitic (furious) rabies (80%)

- **Pituitary dyfunction** : DI or SIADH
- **PE** : ↑ muscle tone, ↑ DTR with extensor plantar, fasciculations, nuchal rigidity

Clinical rabies

Paralytic (dumb) rabies (20%)

- **Flaccid paralysis** : prominent from the bitten limb → spread (a)symmetrically → mild sensory disturbace, paraplegia, loss of sphincter tone
- **PE** : fasciculations, DTR lost

Complications

- Coma 後約 2 weeks 會 expired
- 致死原因：
  - Respiratory arrest (asphyxiation)
  - Cardiac arrhythmia (may due to autonomic dysfunction or viral direct invasion → myocarditis)
  - Central failure (encephalitis → brain edema or automonic dysfuncion → cerebral vasospasm)

TABLE 163-3 Durations of Different Stages of Rabies

Stage	*Duration (% of Cases)*	*Associated Findings*
Incubation period	<30 d (25%) 30-90 d (50%) 90 d to 1 y (20%) >1 y (5%)	None.
Prodrome and early symptoms	2-10 d	Paresthesias or pain at the wound site; fever; malaise; anorexia; nausea and vomiting.
Acute neurologic disease; Furious rabies (80% of cases)	2-7 d	Hallucinations; bizarre behavior; anxiety; agitation; biting; hydrophobia; autonomic dysfunction; syndrome of inappropriate antidiuretic hormone (SIADH).
Paralytic rabies (20% of cases)	2-7 d	Ascending flaccid paralysis.
Coma, death*	0-14 d	—

*Rare recoveries have been reported.

Data from Fishbein DB. Rabies in humans. In: Baer GM, ed. *The Natural History of Rabies*. 2nd ed. Boca Raton, Fla: CRC Press; 1991:519-549.

Laboratory Finding

- Peripheral blood
  - Non-specific, may leukocytosis
- CSF analysis
  - Lymphocytic pleocytosis (60cells/uL)
  - Small increased protein level(<100mg/dL)
  - Normal glucose level

Algorithm for Differential Diagnosis of Rabies

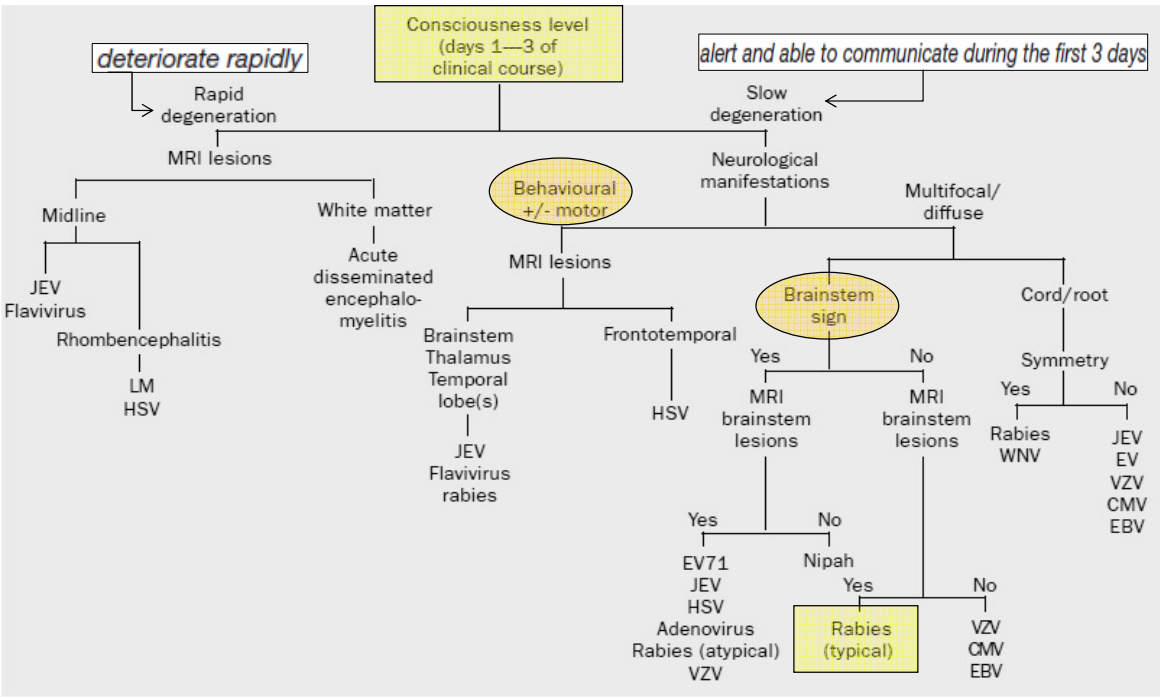


Image finding of Rabies

Figure 163-5 Noncontrast computed tomographic scan sho areas of both severe cerebral edema *(arrows)* and more widesp swelling.

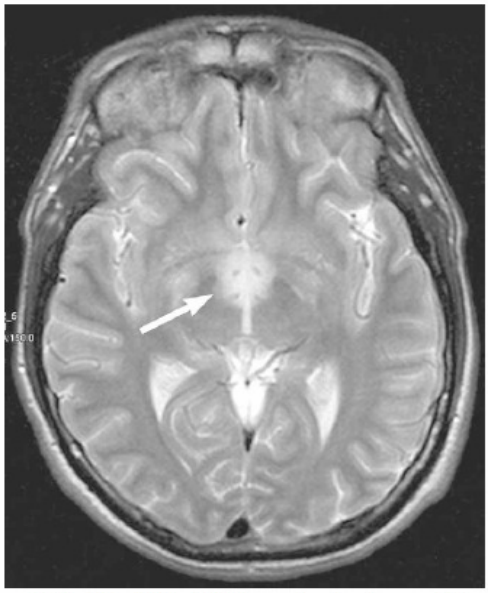
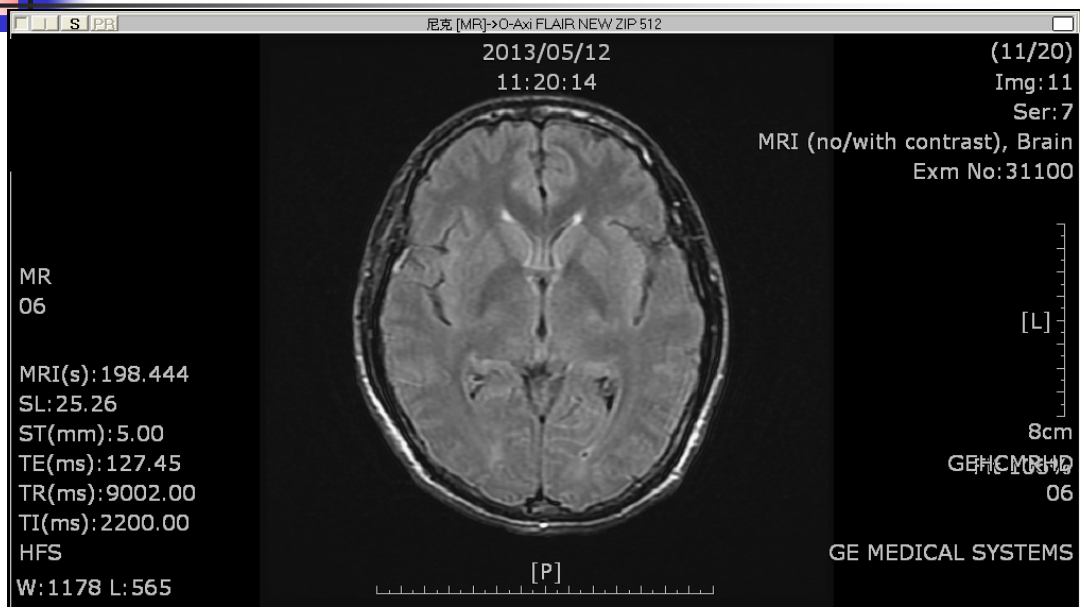


Figure 163-6 T2-weighted MR image showing increased signal in diencephalon *(arrow)*.

0512 Brain MRI



Diagnosis of Rabies

- **Saliva (Sn:63.2%, Sp:70.2%)**
  - detect viral RNA & viral culture
  - Sn near 100% when collect at least 3 samples (intermittent shedding)
- **Skin biopsy (Sn:98%, Sp:98%)**
  - posterior of neck at hairline, 5~6mm thickness, contain cutaneous n.
  - detect viral RNA & antigen
- **Serum and CSF (Sn& Sp: poor)**

Origin of Milwaukee Protocol

The NEW ENGLAND JOURNAL of MEDICINE

BRIEF REPORT

Survival after Treatment of Rabies with Induction of Coma

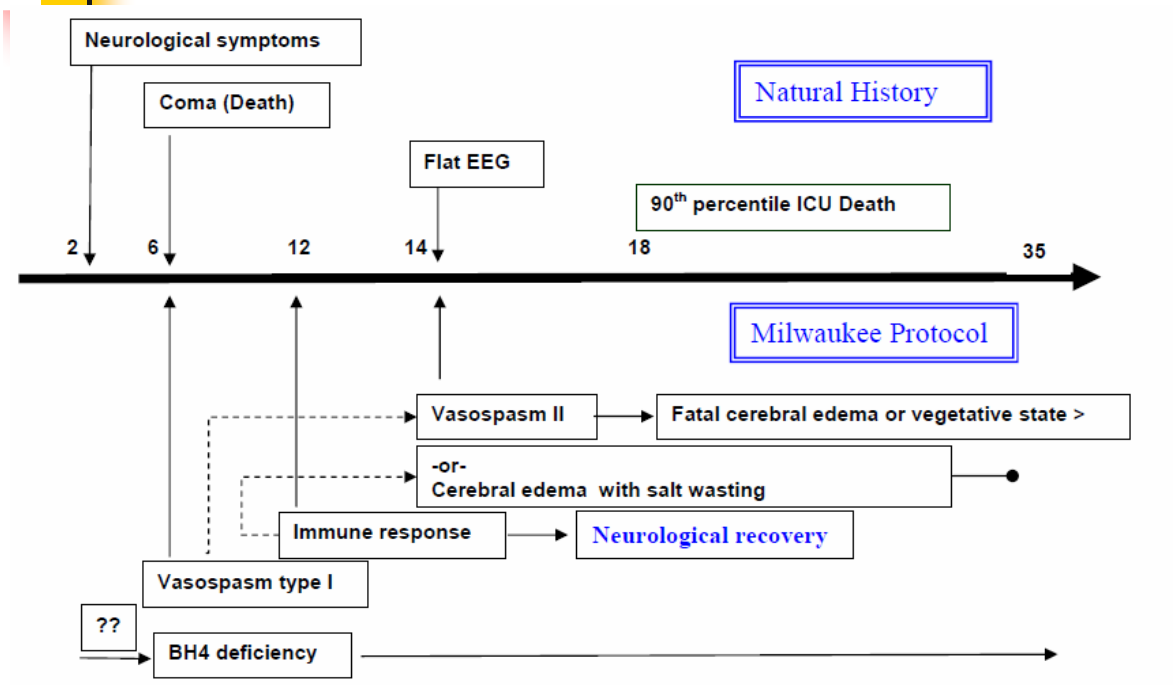
Rodney E. Willoughby, Jr., M.D., Kelly S. Tieves, D.O., George M. Hoffman, M.D., Nancy S. Ghanayem, M.D., Catherine M. Amlie-Lefond, M.D., Michael J. Schwabe, M.D., Michael J. Chusid, M.D., and Charles E. Rupprecht, V.M.D., Ph.D.

N Engl J Med 2005;352:2508-14.

Timeline for Complications

Day 0 Day 3	1. Dehydration, e- imbalance, ketosis 2. Increased ICP 3. Sudden death from cardiac arrest & tachyarrhythmia 4. Catecholamine storm
Day 5	1. Salt-wasting, dehydration, hyponatremia
Day 6	1. Type 1 vasospasm 2. Coma, Declined EEG activity
Day 8	1. CSF lactic acidosis, Complete AV block, Central DI 2. Increased inflammatory markers
Day 13	1. Type 2 vasospasm
Day 15	* Clinical recovery or progression to death

Milwaukee Protocol



Rationale of Treatment

- **Pathology of brain revealed minimal neural loss**
  - reflecting 2nd complication rather than primary brain insult
- **Normal immune system clear the virus**
  - Survivors showed early immune response (no detect RNA or virus)
  - Good outcome depend on prompt host response to eradication virus
- **Causes of death**
  - Neurotransmitter imbalance (ex: NMDA)
  - Autonomic failure

N Engl J Med 2005;352:2508-14

Supportive Care_Palliation (7~10days)

- **Ketamine**
  - Dose: 1~2mg/kg/hr
  - Mechanism: NMDA-receptor antagonist; “specifically” inhibit transcription of the rabies genome in vitro
- **Midazolam**
  - Dose: 1~3.5mg/kg/hr
  - Mechanism: balance hallucination; suppress EEG activity
  - Monitor: metabolic acidosis
  - Tapper dose and add Barbiturate to maintain burst suppress

Milwaukee Protocol, version 3.1

N Engl J Med 2005;352:2508-14

Antiviral Therapy

- **Ribavirin (?)**
  - Dose: 33mg/kg loading → 16 mg/kg Q6H
  - Mechanism: prevent rabies myocarditis
    (poor CNS penetration, but BBB dysfunction in Rabies)
  - Monitor: hemolysis, pancreatitis, mitochondrial toxicity
  - Tapper dose and PRBC transfusion if hemolysis
  - NOT Recommendate after protocol version 3.1
- **Amantadine**
  - Dose: 200mg,QD
  - Mechanism: activity against Rabies in vitro; addictive effect

N Engl J Med 2005;352:2508-14

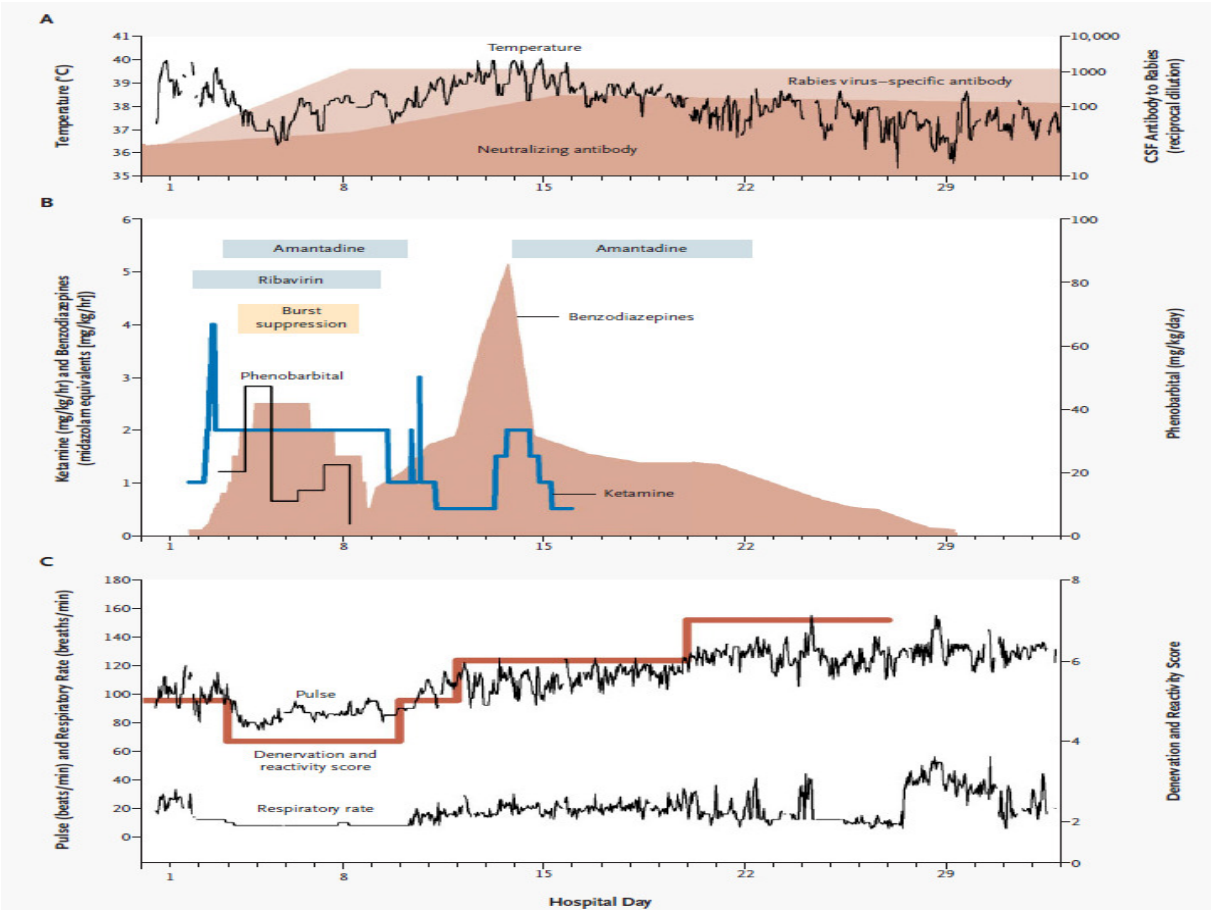
Other Supportive Care

- **Calcium channel blocker (Nimodipine)**
  - **Prophylaxis; avoid vasospasm and CSF lactic acidosis**
- **Minimizing environment stimuli**
  - **Avoid suspend medication for neurological evaluation**
  - **Prevent cardiac arrest**
- **Normal oxygenation and mild hypercapnia**
  - **Could avoid cardiac dsyrthmia and death**
  - **Keep Hb > 10mg/dL**

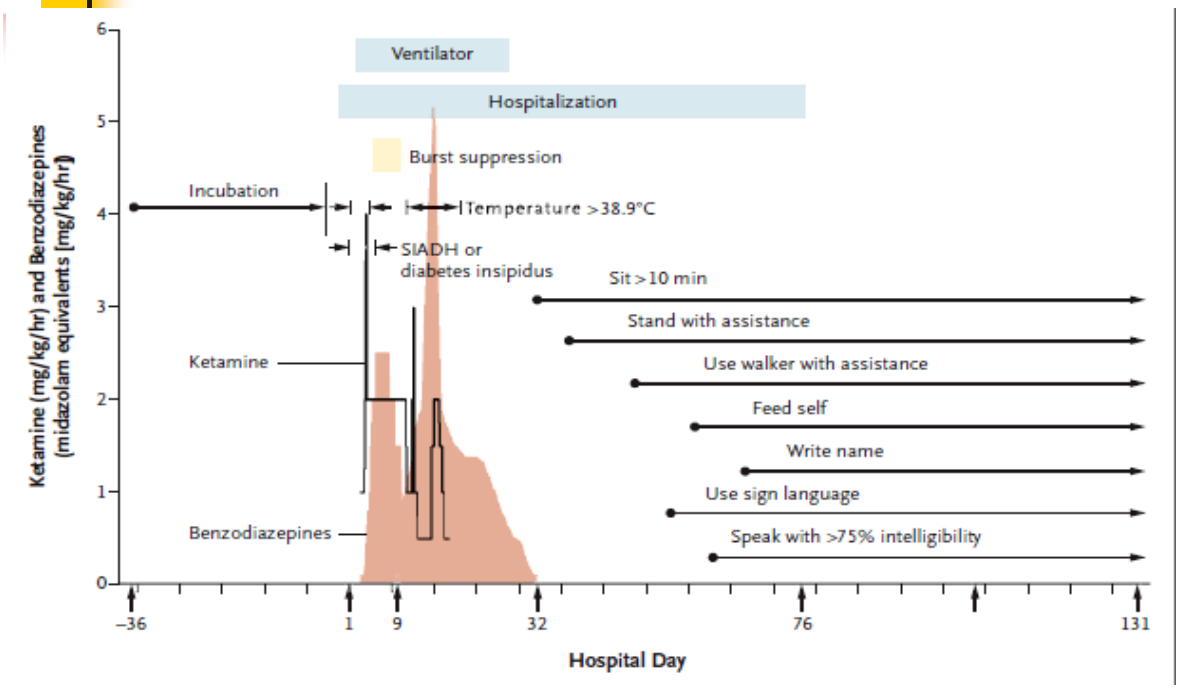
N Engl J Med 2005;352:2508-14

Things Not to Do !

- × Administer vaccine or Immunoglobulin
  - Cause early death
- × Hypothermia therapy
  - Decrease immune response
- × Propofol
  - Over-sedate, progressive CSF lactic acidosis
- × Barbiturate
  - Immunosuppressive property



Timeline from Inoculation to Discharge



Survivors of Rabies (1970~2004)

Patient and reference	Exposure	Treatment	Incubation period and disease	Diagnosis	Outcome
9 years, boy; Ohio USA; 1970[94]	Thumb bite by proven rabid big brown bat *(Eptesicus fuscus)*	Duck-embryo vaccine next day	20 days: encephalitis, weakness of bitten arm, focal seizures, paralysis, cerebral oedema, coma, atrial arrhythmia	High concentrations of antibody in CSF and serum	Intensive care, complete recovery in 6 months
45 years, woman; Argentina; 1972[95]	Bite by clinically rabid dog, which died 4 days later	Suckling-mouse-brain rabies vaccine 10 days later	21 days: signs of cerebellar dysfunction: tremors, myoclonic spasms, ataxia hypertonia, dysphonia; quadriparesis, dysphagia, varying levels of consciousness; cardiac conduction defect	High concentrations of antibody in CSF and serum	Recovered but relapsed twice after vaccine boosters, slow resolution over 1 year
32 years, man; New York, USA; 1977[21,22]	Inhaled aerosol of fixed rabies virus, SAD strain, in laboratory	Only pre-exposure duck-embryo rabies vaccine*	21 days: fever, encephalitis, spastic hemiparesis, myoclonus, impaired consciousness, respiratory arrest	High concentrations of antibody in CSF and serum	Gradual improvement, personality disorder, dementia
9 years, boy; Mexico; 1992[96]	Head bite by proven-rabid dog	Vero-cell vaccine next day	19 days: encephalitis, fever, convulsions, intracranial hypertension, deep coma, quadriplegia	High concentrations of antibody in CSF and serum	Improved slightly, reacted to painful stimuli, blind and deaf; died at 34 months
6 years, girl; India; 2000[97]	Face and hand bites by stray dog, which died 4 days later	No wound cleaning, chick-embryo rabies vaccine same day	16 days: would not drink, fever, hallucinations, coma, excessive salivation, focal seizures	High concentrations of antibody in CSF and serum	3 months of coma slow improvement; at 18 months spasticity, tremors, involuntary movements

Lancet 2004; **363:** 959–69

法定傳染病通報作業

法定傳染病規範

- 疾病分類
  - 本疾病屬第一類法定傳染病，應於24小時內進行通報。
- 疫情調查
  - 疫調應於通報後24小時完成，個案完成5劑疫苗接種或個案死亡後1星期結案。

病例通報定義

- 具有下列任一個條件：

（一）符合臨床條件及流行病學條件。

（二）經醫院自行檢驗，符合檢驗條件。

（三）醫師或法醫師高度懷疑。

臨床條件

- 符合下列部分或全部臨床描述：
  - 一種急性病毒性腦脊髓炎，症狀包括焦慮、頭痛、發燒、被動物咬傷部位之異樣感。焦躁和恐懼氣流是經常出現的症狀。疾病會漸進性發展至麻痺、吞嚥困難，咽喉部肌肉痙攣，以致於引起恐水現象，隨後併有精神錯亂及抽搐等現象。

流行病學條件

- 疾病潛伏期內，具有下列任一個條件：

（一）有狂犬病相關流行地區旅遊史，且曾遭犬、貓、蝙蝠、浣熊等哺乳動物咬傷，或傷口、粘膜曾接觸帶有狂犬病病毒之唾液。

（二）曾接受器官移植者，而器官捐贈者疑似感染狂犬病。

（三）進行狂犬病病毒或檢體實驗室操作。

檢驗條件

- 具有下列任一個條件：

（一）臨床檢體（唾液、血液、腦脊髓液或中樞神經系統組織等）分離並鑑定出狂犬病病毒（Rabies virus）。

（二）臨床檢體分子生物學核酸檢測陽性。

（三）臨床檢體（腦海馬角部份或頸背毛囊周圍的神經）以直接螢光抗體染色法檢測抗原陽性。

（四）血清學抗體檢測陽性。

檢體採檢送驗

檢體種類	採檢目的	採檢時間	採檢量及規定	送驗方式
唾液	病原體檢測	立即採檢	以無菌病毒拭子之棉棒擦拭口腔，插入病毒保存輸送管。	低溫
血清	抗體檢測		以無菌試管收集至少3 mL 血清。	
腦脊髓液	病原體檢測		以無菌試管收集至少1 mL 腦脊髓液。	

狂犬病防治措施

如何預防狂犬病

- 避免接觸野生動物或領養來源不明的野生動物
- 家中的寵物要每年接受狂犬病疫苗接種，並且要避免和野生動物接觸
- 不要隨便餵食流浪狗或流浪貓
- 如有意外暴露，需就醫評估暴露後預防治療
- 高風險族群可考慮接種暴露前疫苗。

暴露前預防疫苗接種建議

暴露分類	危險本質	典型族群	暴露前建議
持續性	1. 病毒會持續出現，通常是高濃度的。 2. 暴露可能未被察覺。 3. 包括咬傷、非咬傷或空氣微粒暴露。	1. 狂犬病研究實驗人員。 2. 狂犬病生物製劑工作人員。	基礎劑接種
經常性	1. 暴露通常是不連續性，而且暴露源是可被察覺的，但暴露源也可能是無法察覺的。 2. 包括咬傷、非咬傷或空氣微粒暴露。	1. 狂犬病檢驗人員。 2. 在狂犬病流行地區從事動物控制和野生動物工作者、洞穴工作者、獸醫和其工作人員。	基礎劑接種。

暴露前預防疫苗接種建議

暴露分類	危險本質	典型族群	暴露前建議
非經常性	1. 暴露幾近偶而性，而且暴露源是可被察覺的。 2. 包括咬傷或非咬傷暴露。	1. 在狂犬病低發生地區的獸醫和動物控制人員。 2. 獸醫學生。 3. 前往狂犬病流行地區旅行但無法即時獲得狂犬病適當醫療照護者。	基礎劑接種
極少	1. 偶而性可察覺的暴露。 2. 包括咬傷或非咬傷暴露。	一般民眾，包括在有動物狂犬病流行地區者。	不需接種疫苗

Thanks for your attention !