WO-13 Bites, stings and envenomation: snakes, dogs, insects and rabies

HEALING after the FALL, research library, WO-13

Researched 10 October 2026 by Claude Opus agent for THRIVING after the FALL, Book Four. Library document, unverified.

Findings by section

This report covers snakebite, dog and cat bites, rabies, bee stings, scorpions, widow and recluse spiders and marine stings, for a household, a village of 300 and a district of 3,000 without antivenom, laboratory or hospital. Washing and irrigating wounds is covered in WO-02 and the decision to close or leave open in WO-03 (THRIVING library, WO-02, WO-03). Those findings are summarised, not repeated. CH-13 (anaphylaxis), IN-15, HY-10 and PH-10 were not in the library, so the anaphylaxis material here is a minimum to reconcile with CH-13 later. The central snakebite source is the WHO South-East Asia guideline by David Warrell, read in full in its 2010 edition (Warrell 2010). Its 2016 edition and the WHO Africa guideline could not be opened.

1. The size of the problem

The WHO estimates 5.4 million snakebites a year, 1.8 to 2.7 million envenomings and 81,410 to 137,880 deaths, with about three times as many amputations and permanent disabilities (WHO 2023). The burden is rural and poor. A nationally representative Indian study estimated 1.2 million snakebite deaths from 2000 to 2019, about 58,000 a year. About 94 per cent were rural, about 77 per cent happened outside a health facility, 28 per cent were children under 15 and half fell in the June to September monsoon. Russell's viper caused 43 per cent of deaths where species was known, kraits 18 per cent and cobras 12 per cent (Suraweera 2020).

Official figures undercount. In eastern Nepal a community study found 4,078 bites and 396 deaths in a year when the ministry recorded 480 bites and 22 deaths nationally (WHO 2023). In Sri Lanka's Monaragala district hospital records missed 63 per cent of snakebite deaths, and in Bangladesh only about 3 per cent of victims reached a hospital or trained doctor, most going to healers (Warrell 2010). After the Fall every community will look like these.

Rabies kills about 44,203 people a year by the WHO's 2021 model, with dogs the source of up to 99 per cent of human cases and children under 15 about 40 per cent of deaths (WHO rabies fact sheet). Scorpions sting more than 1.2 million people a year and kill more than 3,250 (Chippaux and Goyffon 2008).

2. Which snakes matter, and how they kill

The Elapidae (cobras, kraits, mambas, coral snakes, sea snakes and the Australasian elapids) have short fixed front fangs. The Viperidae (Russell's viper, saw-scaled vipers, adders, and pit vipers such as rattlesnakes and lanceheads) have long folding fangs (Warrell 2010). By region:

- South Asia: Russell's viper (*Daboia russelii*), common krait (*Bungarus caeruleus*), spectacled cobra (*Naja naja*), saw-scaled viper (*Echis carinatus*), and the hump-nosed pit viper (*Hypnale hypnale*) in Sri Lanka and south-west India (Warrell 2010).

- South-East Asia: Malayan pit viper (*Calloselasma rhodostoma*), monocled cobra (*Naja kaouthia*), Malayan krait (*Bungarus candidus*) and, in Myanmar, the eastern Russell's viper (*Daboia siamensis*), about 90 per cent of that country's bites (Warrell 2010).
- Sub-Saharan Africa: the West African carpet viper (*Echis ocellatus*), with 497 bites per 100,000 people a year in Nigeria's Benue valley (Habib 2008), the puff adder (*Bitis arietans*), cobras and mambas (*Dendroaspis*). Africa has 435,000 to 580,000 bites a year needing treatment (WHO 2023).
- The Americas: lanceheads (*Bothrops*) and rattlesnakes (*Crotalus*). About 98 per cent of North American venomous bites are by pit vipers, and fewer than 0.2 per cent of victims die (Seifert 2011).
- Australia and New Guinea: taipans (*Oxyuranus*), brown and tiger snakes, which paralyse and stop blood clotting with little local swelling (Warrell 2010).

The brief's division into neurotoxic, haemotoxic and cytotoxic venoms is a teaching device. Asian cobras can cause severe local necrosis, and Sri Lankan Russell's vipers cause drooping eyelids and dark urine (Warrell 2010). Warrell uses five syndromes instead:

1. Local swelling with bleeding or failure to clot: a viper.
2. The same with shock or kidney failure: Russell's viper.
3. Local swelling with paralysis: a cobra.
4. Paralysis with little local swelling: a krait if bitten asleep on the ground, a sea snake if bitten in the sea.
5. Paralysis with dark brown urine: Russell's viper in Sri Lanka and south India, some kraits, or a sea snake (Warrell 2010).

Neurotoxic envenoming begins with drowsiness, drooping eyelids, double vision, a nasal voice and trouble swallowing saliva, and progresses to paralysis of breathing. Haemotoxic envenoming shows as bleeding from the fang marks, gums, nose, old wounds and into urine or vomit. Cytotoxic envenoming shows as spreading painful swelling, blisters, tender glands and later blackened dead tissue. Early vomiting suggests systemic envenoming (Warrell 2010). Kraits bite at night people sleeping on the floor, the bite may be painless, and the victim may wake paralysed. Paralysed patients are fully conscious, and Warrell records a Bangladeshi child who was almost placed on a funeral pyre (Warrell 2010).

3. What happens without treatment

About half of bites by venomous snakes inject no or too little venom, the dry bite (Warrell 2010). Any remedy given to a hundred victims will seem to save about half, which is why folk remedies keep their reputation. Death is usually slow. Many hours pass before death after elapid bites, and several days after viper bites. Death within minutes is rare and reputed for the king cobra (Warrell 2010).

Untreated mortality by species is patchy and old. None of these is a clean "no treatment" figure.

Species or setting	Case-fatality	Conditions	Source
Echis ocellatus, Nigeria	10 to 20% untreated	Community estimates from the 1970s	Habib 2008
Cobras, Bangladesh 1988 to 1989	40% (all species 22%)	Records of 764 bites	Warrell 2010
Russell's viper country, Myanmar	7.9% average, 10 to 40% in some townships	Mixed treatment	Warrell 2010
Common krait, Sri Lanka	7 of 42 (17%)	With antivenom and ventilation	Kularatne 2002
Puff adder, Nigeria	2 of 10	Treated series	Warrell 1975
Malayan pit viper	about 1 to 2% [VERIFY]	Reid's series	VAPAguide

Species or setting	Case-fatality	Conditions	Source
Taipan before 1956	near 100%, two known survivors [VERIFY]	No antivenom	AVRU
Black mamba	"near 100%" [VERIFY]	No primary data found	none
North American rattlesnakes before antivenom	5 to 25% [VERIFY]	Retrospective estimates	eMedicine
Thailand, all species, recent	0.5%	Antivenom and hospital	Warrell 2010

Thailand cut deaths from 178 a year in the 1950s to fewer than 10 with antivenom and hospital care (Warrell 2010). Without them, a village should expect deaths of roughly one in ten to one in five among people genuinely envenomed by the dangerous African and Asian vipers and cobras, and more after krait or mamba bites if no one can breathe for the patient [VERIFY: my inference from the table]. Children and the old fare worst, and pregnant women risk bleeding and miscarriage (Warrell 2010, WHO 2023).

4. First aid that helps

Warrell's aims are to slow venom spread, keep the patient alive, arrange transport and "above all, aim to do no harm" (Warrell 2010). His measures: reassure, lay the patient down and keep the whole body still, splint the bitten limb because muscle contraction speeds venom absorption, do nothing to the wound, and carry the patient lying down, in the recovery position if vomiting (Warrell 2010). In volunteers given a radioactive tracer, rest rather than walking reduced spread from the leg (4 of 13 against 9 of 9) (Howarth 1994, in Avau 2016). The Belgian Red Cross review of 14 studies rated all first-aid evidence low or very low, found no measure both effective and feasible for lay people, and recommended immobilising victim and limb (Avau 2016). In Nepal's Terai, motorcycle volunteers carried patients upright between driver and pillion, which Warrell reports as effective (Warrell 2010). After the Fall the equivalent is a pre-arranged cart or stretcher team.

5. Pressure-immobilisation

Struan Sutherland and colleagues published the method in the Lancet in 1979. In monkeys given tiger snake (*Notechis scutatus*) venom, a firm crepe bandage over the whole limb at about 55 mmHg with a splint kept circulating venom very low, while either measure alone failed (Sutherland 1979). The WHO version: an elastic bandage 10 to 15 cm wide and at least 4.5 m long, wound from fingers or toes over the whole limb with a splint, at 50 to 70 mmHg, keeping the pulse below present (Warrell 2010). The Australian Venom Research Unit's lay test is as tight as for a sprained ankle (AVRU). The pressure-pad variant, studied in Myanmar for Russell's viper, uses a pad about 5 cm square and 2 to 3 cm thick bound over the bite with a non-elastic bandage at 70 mmHg or more (Warrell 2010). A firmly bound cloth pad delayed tracer spread from 26 to 74 minutes in one study, while a crepe bandage at 55 mmHg did not (Anker 1982, in Avau 2016). The sources differ on what counts as enough pressure.

Three objections stand.

- Lay people cannot apply it. Only 5 to 13 per cent of applications were correct in simulations, and after intensive training correct tension fell from 60 per cent at one hour to 25 per cent at three days (Avau 2016).
- It may harm the limb after viper bites. Seifert, White and Currie argue that for North American pit vipers it raises tissue pressure towards the range that prompts fasciotomy, to save very few lives (Seifert 2011). Two Australian patients whose bandages stayed on for 9.5 and 7.5 hours developed severe muscle breakdown, one with compartment syndrome (Queensland Health 2023).
- Release can bring sudden collapse as held-back venom enters the circulation (Warrell 2010).

The WHO keeps it for bites where an elapid cannot be excluded (Warrell 2010). A 2024 UN procedure limits it to paralysing snakes with little local damage (UN 2024). The 2024 American Heart Association and Red Cross guideline reportedly discourages it for rattlesnakes [VERIFY: text not read] (Arizona Poison Center). The rule for the book is regional: teach it to the village healer where kraits, mambas, coral snakes, sea snakes or Australasian elapids are the killers and evacuation takes hours. Where vipers dominate, teach splinting and stillness only.

6. First aid that harms

The WHO lists incisions, suction, black stones, tight bands, electric shock, chemicals, herbs and ice as useless or dangerous (Warrell 2010).

- **Cutting** was followed by more local swelling (risk ratio 1.66) (Bhat 1974, in Avau 2016) and invites bleeding and infection in a patient who cannot clot.
- **Suction.** A suction pump applied to eight volunteers recovered 0.04 per cent of a radioactive mock venom (Alberts 2004).
- **Tourniquets** must stop the pulse to work, are agonising, and cause gangrene if left longer than about 40 minutes (Warrell 2010). They were associated with severe local envenoming in Brazil (adjusted odds ratio 4.31) and more skin grafting in Taiwan (risk ratio 2.06) (Avau 2016). If a tight band is already on, Warrell advises leaving it until antivenom and resuscitation are ready (Warrell 2010). After the Fall that may never happen, so it should be loosened gradually under watch by the healer [VERIFY: my inference].
- **Ice.** Stahnke's "ligature and cryotherapy" method was promoted in Arizona from 1953. A review quoted 36 amputations in children of which 27 followed cryotherapy, and a 1968 Navy study in dogs showed skin necrosis (Arizona Poison Center, citing Watt 1978) [VERIFY].
- **Electric shock.** A 1986 Lancet letter from Ecuador reported more than 60 uncontrolled cases (Guderian 1986). It failed in rattlesnake envenoming and gave mice no benefit (Dart 1991).
- **Snake stones** did not change the lethal dose of *Bitis arietans* venom in mice (Chippaux 2007).
- **Other harms.** Plant juices in the eyes, oils forced into the airway, cauterising and scalding cause injuries of their own (Warrell 2010). The greatest harm is delay. In eastern Nepal a first visit to a healer was a risk factor for death (Warrell 2010).

7. Traditional remedies

Giovannini and Howes found 208 plant species used for snakebite in Central America alone. Nine appeared in three or more studies, including *Cissampelos pareira*, *Piper amalago*, *Aristolochia trilobata* and *Dorstenia contrajerva*. They found no clinical trial of efficacy or safety (Giovannini 2017). This research found no controlled human trial of any plant against snakebite death or disability, in India, Africa or the Americas.

The only human comparison points the other way. In a Nigerian hospital series, death or disability followed in 8 of 15 patients given applied concoctions against 1 of 15 without (odds ratio 15), and in 6 of 10 given concoctions to drink (odds ratio 20) (Michael 2011, in Avau 2016). The series is small and confounded.

Aristolochia (snakeroot, birthwort) has been used for snakebite on every continent. Its aristolochic acids cause progressive kidney scarring, and IARC classifies remedies containing it as carcinogenic to humans, Group 1 (IARC 2002). A Russell's viper victim already risks kidney failure. Indian birthwort (*Aristolochia indica*, root) and Virginia snakeroot (*Aristolochia serpentaria*, root) must be named as never to be given.

Tradition says these remedies neutralise venom. The record shows no benefit where measured and harm in one series. Science finds venom-enzyme inhibition by some extracts in the test tube. Varespladib, an oral enzyme inhibitor, missed its primary endpoint in a 95-patient trial (Ophirex 2024). Plants earn grade D for benefit, and X when drunk, put in the wound or eye, or made of *Aristolochia*.

8. Antivenom: salvage, storage and use

Antivenom is horse or sheep antibody against specific venoms and the only treatment that reverses most effects (WHO 2023). Freeze-dried antivenom keeps about five years below 25°C, liquid antivenom two to three years at 2 to 8°C and must never freeze. Properly stored antivenom often keeps useful activity after expiry, and recently expired stock may be used in severe envenoming if nothing else exists. Cloudy liquid antivenom must be discarded (Warrell 2010). It only works against the species it was raised against (Habib 2008).

More than 10 per cent of patients react, usually 10 to 180 minutes after starting, and some have anaphylaxis (Warrell 2010). Adrenaline is drawn up first: 0.5 mg of 1 mg/mL adrenaline into the thigh muscle for an adult, 0.01 mg/kg for a child, repeated every 5 to 10 minutes (Warrell 2010). Resuscitation Council UK gives the same adult dose repeated at 5 minutes, and 300 micrograms at 6 to 12 years and 150 micrograms from 6 months to 6 years (Resuscitation Council UK 2021). The two sources differ on repeat interval only. Adrenaline under the skin before antivenom cut reactions from 43 to 11 per cent in 105 Sri Lankans, but a later death from brain bleeding raised doubts (Warrell 2010). Patients are watched for two hours (Warrell 2010).

The village test for envenoming is the 20-minute whole blood clotting test. Put 2 mL of fresh venous blood in a new or heat-cleaned, dry glass tube, leave it untouched 20 minutes, then tip it once. Blood that runs out liquid means venom-induced coagulopathy, in Asia a viper. Glass cleaned with detergent, or plastic, invalidates it, so run a healthy person's blood alongside (Warrell 2010). Across 12 studies, sensitivity against a laboratory test was 0.84 and specificity 0.91 (Lamb 2021).

9. Nursing without antivenom

This is what a village can do. Assisted ventilation with room air has been followed by full recovery after more than a month, and manual bag ventilation by relays of relatives and nurses has kept patients alive where no machine existed. Warrell notes that patients "continue to die of asphyxiation" because doctors trust antivenom alone (Warrell 2010). Mouth-to-mouth through a thin cloth gives about 16 per cent inspired oxygen (Warrell 2010). In Kularatne's krait series 60 per cent needed ventilation and 7 of 42 died, mostly of lung injury, heart rhythm problems or late arrival (Kularatne 2002). Before breathing fails, put the patient in the recovery position so saliva drains (Warrell 2010).

Where neostigmine and atropine are salvaged, give atropine 0.6 mg intravenously (50 micrograms/kg for children), then neostigmine 0.02 mg/kg into muscle (0.04 mg/kg for children), and watch 30 to 60 minutes for the eyelids to lift. If it works, continue 0.5 to 2.5 mg every one to three hours, maximum 10 mg a day, with atropine. It helps cobra bites more than krait bites (Warrell 2010). This is a single-source dose [VERIFY].

For bleeding: strict bed rest, no injections into muscle, pressure on every puncture, fresh whole blood from a matched donor if possible, and no aspirin or anti-inflammatory drugs. Paracetamol to a maximum of 4 g a day (Warrell 2010). For dark urine: correct dehydration and chart urine output (Warrell 2010). Without dialysis, kidney failure after Russell's viper bite is often fatal [VERIFY].

The limb is rested comfortably, not raised high. Many unnecessary fasciotomies are done, and cutting a limb that will not clot can kill. In one Malayan pit viper victim, fasciotomy before clotting was corrected led to ten days of bleeding and 20 units of blood (Warrell 2010). A village must never cut a swollen snake-bitten limb. Steroids do not help, and preventive antibiotics failed in a Brazilian trial, so antibiotics are kept for wounds that were cut or are infected (Warrell 2010). Spitting cobra venom in the eye is washed out with large amounts of water or any bland liquid, without antivenom or steroid drops (Warrell 2010).

10. Dog, cat and human bites

WO-02 and WO-03 cover cleaning and closure: irrigate generously with drinkable water, close only fresh clean face bites, and leave open cat bites, hand bites, punctures and wounds more than a few hours old. Infection follows 8

to 14 per cent of dog bites and 47 to 58 per cent of cat bites (THRIVING library, WO-03). Two findings matter here. *Pasteurella* was found in 50 per cent of infected dog bites and 75 per cent of infected cat bites, and infection appeared at a median 12 hours after cat bites against 24 hours after dog bites (Talan 1999). Preventive antibiotics gave no clear benefit for bites overall (odds ratio 0.49), but for hand bites infection fell from 28 to 2 per cent (odds ratio 0.10, number needed to treat 4) (Medeiros 2001). Salvaged antibiotics go first to hand bites, cat bites and deep punctures.

11. Rabies

Lethality. Once symptoms appear rabies is fatal in essentially all cases. About 20 per cent take the paralytic rather than the furious form. Incubation is usually two to three months and ranges from one week to a year (WHO rabies fact sheet). Induced coma, the "Milwaukee protocol", followed the survival of Jeanna Giese in 2004 but has failed at least 31 times by a 2015 count and at least 64 by 2025, and its critics, notably Alan Jackson, call for it to be abandoned (Zeiler and Jackson 2016).

Risk after a bite. Without prophylaxis, a bite by a rabid dog transmits rabies in about 45 per cent of head and neck bites (30 to 60), 28 per cent of hand and arm bites (15 to 40) and 5 per cent of trunk and leg bites (Tenzin 2011, citing Cleaveland 2002).

Washing. The WHO advises washing with soap and water for at least 15 minutes (WHO rabies fact sheet) and immediate washing of all category III wounds (WHO 2018). In guinea pigs infected with rabies virus and treated an hour later, a single flush with 20 per cent soap gave no protection, while repeated swabbing and flushing with soap, or 2 per cent benzalkonium chloride, did (Kaplan 1962). Dean, Baer and Thompson called local treatment "a valuable adjunct" to serum and vaccine (Dean 1963). No human study shows washing alone prevents rabies, and the claim that it cuts risk by up to 90 per cent could not be traced [VERIFY]. WO-02 keeps soap out of wounds because it raised reoperation rates in open fractures (THRIVING library, WO-02). For a possibly rabid bite the rabies rule wins. For bites that cannot carry rabies, WO-02 stands. Rabies-prone wounds are left open, with closure delayed about four days (THRIVING library, WO-03).

Watching the dog. A healthy dog, cat or ferret that bites can be confined and watched for 10 days. Virus appears in saliva only shortly before illness, so an animal well at 10 days was not infectious when it bit. No American is known to have caught rabies from a dog, cat or ferret that stayed healthy through confinement (CDC). This is the village's best decision tool. It does not apply to wild animals.

Pasteur. On 6 July 1885 Louis Pasteur began treating Joseph Meister, aged 9, with 13 injections of dried rabbit spinal cord over about ten days, and he survived (Pasteur history). On 20 October 1885 he began treating Jean-Baptiste Jupille, a 15-year-old shepherd bitten defending younger children (Institut Pasteur). By February 1886, 350 people had been treated with one failure [VERIFY] (Pasteur history). Critics then argued that many treated had been bitten by dogs that were not rabid.

Can a district make rabies vaccine? Only trained laboratory workers with animal facilities have done it. The nerve-tissue vaccines that followed Pasteur's, such as Semple's sheep-brain vaccine, caused neurological complications in about 1 in 1,000 courses by one account and 8.31 per 1,000 with 1.39 deaths per 1,000 in a Bangkok study (Semple sources). The WHO has advised replacing them since 1984. A post-Fall district would need a laboratory, animals, someone experienced and a potency test. This report gives no method.

Salvaged vaccine and immunoglobulin. Cell-culture vaccine is given as 0.1 mL into the skin at two sites on days 0, 3 and 7. Previously vaccinated people need days 0 and 3 only (WHO 2018). The intradermal route cuts vaccine use and cost by 60 to 80 per cent (WHO rabies fact sheet), so one vial covers several people. Immunoglobulin, 20 IU/kg human or 40 IU/kg equine, is infiltrated in and around the wound once, within 7 days of the first vaccine dose (WHO 2018). A canine vaccine kept full effect after six months at 25°C or three months at 30°C (Lankester 2016), but human vaccine stability outside the cold chain was not confirmed [VERIFY].

Controlling dogs. Mass dog vaccination is the most cost-effective way to prevent human rabies (WHO rabies fact sheet). The target is 70 per cent of dogs (Coleman and Dye 1996). Without vaccine a village can register dogs, tie up or remove any that bite unprovoked or change behaviour, and kill dogs with signs of rabies. Whether culling alone controls rabies was not researched [VERIFY].

12. Bees, wasps and anaphylaxis

Most sting deaths are anaphylaxis, treated with intramuscular adrenaline as above. A honeybee sting should be removed as fast as possible by any means: venom delivered rises with every second, and scraping and pinching gave the same weal (80 against 74 square millimetres) (Visscher 1996). Swarm attacks kill by direct toxicity. Case reports cite toxic effects from about 50 stings in an adult, deaths of children after 30 to 50 stings, and muscle breakdown and kidney failure 48 to 72 hours later (Bee case reports) [VERIFY]. After a swarm, count stings, give generous fluids and watch urine for three days.

13. Scorpions

Most stings cause pain only. The Indian red scorpion (*Mesobuthus tamulus*) causes an autonomic storm with lung fluid and heart failure. Himmatrao Bawaskar, a rural doctor in Maharashtra, reported deaths of 25 to 30 per cent before 1983 and under 1 per cent after he introduced prazosin (Bawaskar 2011). His randomised trial of 70 patients found antivenom plus prazosin worked faster than prazosin alone (Bawaskar 2011). A non-randomised series of 62 Indian children gave prazosin 30 micrograms/kg every three hours, with 14.3 per cent deaths on prazosin alone and 7.4 per cent with antivenom, not significant (Pandurang 2014). A child stung by a dangerous species is kept lying still and watched, and sent on if sweating, vomiting, cold or breathless.

14. Widow and recluse spiders

Widow spiders (*Latrodectus*) cause severe pain, sweating and cramps. Bogen's 1926 series of 380 cases recorded 17 deaths (Bogen 1926) [VERIFY], but recent American experience of tens of thousands of bites has none. Redback antivenom improved pain in 34 against 23 per cent on placebo, not significant, in 224 patients (Isbister 2014). Pain relief and reassurance are the treatment.

Recluse spiders (*Loxosceles*) are blamed for many wounds they did not cause. Most bites heal without treatment (Swanson and Vetter 2005). Vetter estimates 90 per cent heal, 10 per cent form dead skin and under 1 per cent cause systemic illness, mostly destruction of red cells in children (Swanson and Vetter 2005). Many supposed spider bites are skin infections needing WO-02's care. Check the urine of children under 12 for blood (Vanderbilt 2014).

15. Marine stings

Box jellyfish (*Chironex fleckeri*) have killed more than 60 people in Australia, some within minutes (Welfare 2014). Hartwick and colleagues showed in 1980 that 3 to 10 per cent acetic acid inactivates undischarged stinging cells, and vinegar for 30 seconds became Australian first aid (Welfare 2014). A 2014 laboratory study suggested vinegar can increase discharge from cells already fired (Welfare 2014). Vinegar is not for lion's mane or sea nettle. CPR saves life.

For pain, a Cochrane review favoured hot water over ice on low-quality evidence (Li 2013). In 96 bluebottle (*Physalia*) victims, 87 per cent improved with 45°C water at 20 minutes against 33 per cent with ice (Loten 2006). For box jellyfish, hot water was no better than ice (Isbister 2017).

Stonefish, scorpionfish and stingray venoms are destroyed by heat: 99 per cent of stonefish venom activity was lost at 42.1°C over 20 minutes or 44.6°C over 5 minutes (Barnett 2017). Protocols differ: 45°C for 20 to 30 minutes (Queensland Poisons) or 40 to 45°C for at least 30 minutes in a Hong Kong series of 32, one of whom needed fasciotomy (Hong Kong 2019). Necrotising fasciitis has followed hot-water treatment (Tang), so watch the wound.

Evidence grades

A: consistent trials. B: animal, physiological or consistent observational evidence. C: expert consensus or weak data. D: tradition or anecdote only. X: evidence of harm or no benefit.

Practice	Grade	Tradition says	Record shows	Science infers
Rest and splint the limb	B	Common sense	Tracer studies favour rest	Muscle pumps venom
Pressure-immobilisation, elapid bites	C	Australian standard since 1979	Animal and tracer data, poor lay skill	Plausible, regional
Pressure-immobilisation, viper bites	X	Older guidelines	Raised tissue pressure, case harms	Risk outweighs benefit
Cutting, suction, tourniquet	X	Release or hold the poison	More swelling, gangrene, 0.04% removed	Harmful or useless
Ice, electric shock, snake stone	X	Slow or neutralise venom	Amputations, no benefit	Harmful or useless
Herbal concoctions	D for benefit, X if drunk or applied	Antidote	More death or disability in one series	Test-tube activity only
Aristolochia	X	Snakeroot	Kidney failure, cancer	Toxic
Matched antivenom	A	None	Reverses most effects	The only antidote
Manual ventilation for paralysis	B	None	Full recovery after weeks	Paralysis reverses
Neostigmine, cobra paralysis	B	None	Variable, poor for kraits	Partial reversal
20-minute clotting test	B	None	Sensitivity 0.84	Valid screen
Fasciotomy	X without measured pressure and clotting	Relieve pressure	Bleeding, disability	Usually unnecessary
Soap washing, rabies risk	B animal, D human	None	Protects guinea pigs	Kills enveloped virus
10-day dog watch	B	None	No case after a dog stayed well	Shedding precedes illness
Cell-culture vaccine and immunoglobulin	A	None	Near-complete protection	Standard
Nerve-tissue vaccine	X today	Pasteur's method	Neurological injury up to 1 in 120	Replaced
Induced coma for clinical rabies	X	None	At least 64 failures	Unproven
Antibiotics for hand bites	A	None	Infection 28% to 2%	Benefit

Practice	Grade	Tradition says	Record shows	Science infers
Fast bee-sting removal	B	Scrape, never pinch	Speed matters, method does not	Venom keeps pumping
Prazosin, Indian red scorpion	B	None	Mortality fall, one group	Blocks adrenergic storm
Widow antivenom	A for no clear benefit	None	Not better than placebo	Pain relief suffices
Vinegar, box jellyfish	C	Australian standard	Lab data, contested	Stops further discharge
Hot water, fish and bluebottle	B	Folk and clinical	Pain relief in trial and series	Heat-labile venom

Means ledger

Practice	Hands alone	Hearth	Garden and still	Village dispensary	District infirmary	Pre-Fall hospital
Snakebite first aid	Reassure, lie still, splint, remove rings	Stretcher, sling	Same	Bandages and pads in elapid regions, adrenaline	Same	Antivenom
Diagnosis	Hourly check of eyelids, swallowing, bleeding, swelling	Same	Same	20WBCT with glass tube and syringe	Urine checks	Laboratory
Paralysis	Mouth-to-mouth through cloth, recovery position	Same	Same	Bag and mask, relays, neostigmine if salvaged	Airway tubes, 24-hour nursing	Ventilator
Bleeding	Bed rest, pressure	Same	Same	No injections, paracetamol	Fresh whole blood	Plasma, antivenom
Kidney failure	Fluids by mouth	Same	Same	Fluid chart	Intravenous fluids	Dialysis
Mammal bites	Wash with water	Boiled water, soap for rabies risk	Diluted bleach per WO-02	Irrigation kit, antibiotics	Delayed closure, drainage	Standard
Rabies	Wash 15 minutes, tie up dog, watch 10 days	Soap	Iodine or benzalkonium if salvaged	Exposure and dog register	Salvaged vaccine, immunoglobulin	Full prophylaxis
Bee stings	Remove sting	Cold cloth	Same	Adrenaline	Fluids, urine watch	Intensive care
Scorpions	Keep still	Same	Same	Observation	Prazosin if salvaged	Antivenom

Practice	Hands alone	Hearth	Garden and still	Village dispensary	District infirmary	Pre-Fall hospital
Marine	Remove tentacles, CPR	Vinegar, 45°C water	Same	Pain relief	Wound care	Antivenom

For snakebite, the lower rungs change outcome mainly by avoiding harm and by getting the patient to someone who can breathe for them. The dispensary saves paralysed patients if it has a bag and trained relays. The district saves bleeders by transfusion. Only antivenom, which no rung can make, reverses severe viper envenoming. For rabies, washing and the dog watch are the only tools until a district has salvaged vaccine.

Harm test

Pressure-immobilisation. Harms by being too tight (ischaemia, compartment syndrome, muscle breakdown after hours), by use on viper bites, and by sudden release. Never on viper bites in viper regions. Warning signs: pain beyond the bite, cold or blue fingers or toes, absent pulse. Then loosen over minutes with ventilation ready (Queensland Health 2023, Warrell 2010).

Tourniquet, cutting, sucking, burning, shock, ice. Gangrene after about 40 minutes, bleeding, infection, burns and amputation. Never use. If done, clean the wound per WO-02 and give antibiotics and tetanus cover where possible (Warrell 2010).

Herbal remedies. Harm by delay, vomiting, aspiration of oils, eye injury and kidney poisoning. Never *Aristolochia*. Nothing in the eyes or airway. Nothing by mouth to a patient who cannot swallow (Warrell 2010, Avau 2016).

Antivenom. Reactions in more than 10 per cent and some anaphylaxis, within 10 to 180 minutes. Wrong species or cloudy product adds risk without benefit. At the first itch, hive, cough or wheeze, stop and give adrenaline (Warrell 2010).

Adrenaline. Too much, or given into a vein, causes dangerous blood pressure rises, heart rhythm problems and brain bleeding, a particular risk when venom has stopped clotting (Warrell 2010). Thigh muscle only, 1 mg/mL strength, weight-based in children.

Neostigmine. Excess causes slow pulse, drooling, cramps and paradoxical weakness. Atropine first (Warrell 2010).

Fasciotomy. Kills by bleeding in an unclotted patient. Never in the village.

Soap in a rabies-risk wound. A small extra risk of wound complications (WO-02), accepted for possible rabies only.

Closing a bite. Infection, especially of cat and hand bites (WO-03).

Hot water. Scalds a numb limb, and infection may follow fish stings (Tang). Test the water on the rescuer's own skin.

Vinegar. May worsen lion's mane stings.

Who must never receive what. Children need weight-based doses and suffer faster, more severe envenoming. Pregnant women risk bleeding and miscarriage. People with heart disease face more risk from adrenaline (Warrell 2010).

Red flags

1. **Drooping eyelids, double vision, trouble swallowing saliva, nasal voice** after a snakebite: paralysis is coming. Recovery position, call the ventilation relay, send to the district.

2. **Blood still liquid at 20 minutes, bleeding gums, blood in urine or vomit, sudden headache or drowsiness**: risk of brain bleeding. Strict bed rest, no injections, fresh whole blood if possible.
3. **Little urine for 12 hours or dark brown urine** after a viper bite, swarm attack or sea-snake bite: kidney failure, often fatal without dialysis.
4. **Collapse, cold limbs, weak fast pulse**: shock. Lie flat, raise the legs, give fluids.
5. **A tense, cold, blackening or foul limb**: dead tissue and infection. Treat as WO-02 and prepare the family for amputation at the district.
6. **Any sign of rabies**: tingling at the old bite, fear of water, throat spasms on drinking, agitation or creeping paralysis. Death will follow.
7. **A stung child sweating, vomiting, breathless or coughing frothy sputum**: scorpion heart failure.
8. **Collapse within minutes of a box jellyfish sting**: start CPR.

Honest comfort. For rabies once symptoms start, nothing saves the patient. Keep them in a quiet, dim room, give water and food as they can take it, sedate if anything exists, and let the family stay. Carers should avoid bites and saliva on broken skin or eyes [VERIFY]. Tell the family that nothing done after symptoms began could have changed it. For the paralysed snakebite patient, remember they hear everything. Talk to them, lift their eyelids so they can see, and never declare death while the heart still beats (Warrell 2010).

The case against

Against hospital romance. Most victims never reach hospital (Warrell 2010). Antivenom is often mismatched in Africa (Habib 2008), reacts in one in ten, and Kularatne still lost 17 per cent of krait patients with it (Kularatne 2002). Surgeons' fasciotomies have maimed many (Warrell 2010). The village is not helpless: hand ventilation, bed rest and fluids save lives without drugs.

Against pressure-immobilisation. Seifert, White and Currie argue it is wrongly exported to viper regions, hard to apply and damaging to tissue (Seifert 2011). The Belgian Red Cross review found no first-aid measure both effective and feasible (Avau 2016).

Against dismissing traditional remedies. Absence of trials is not proof of failure, test-tube activity is real, and healers give reassurance (Giovannini 2017). The answer is that reassurance needs no delay or poison, and the only human comparison showed harm (Avau 2016).

Against the washing rule. No human study proves washing alone prevents rabies, and one soap flush failed in guinea pigs (Kaplan 1962). It is the best available act, not a cure.

Against the Pasteur legend. Many of those treated had not been bitten by rabid dogs, and nerve-tissue vaccines later injured many (Semple sources).

Against Bawaskar's figures. The fall from 30 to 1 per cent comes from one group, and a later Indian series recorded 11.2 per cent mortality with antivenom and prazosin (Indian Pediatrics 2014).

10-line summary

1. Snakebite kills 81,000 to 138,000 people a year, mostly rural and outside hospital (WHO 2023).
2. About half of venomous bites are dry, which explains the reputation of useless remedies (Warrell 2010).
3. Death takes hours after elapid bites and days after viper bites, so there is time (Warrell 2010).
4. Rest and splinting help, and pressure-immobilisation only for paralysing elapids (Avau 2016, Seifert 2011).
5. Cutting, sucking, tourniquets, ice, shocks, stones and concoctions do no good and some do great harm (Warrell 2010).
6. Breathing by hand for a paralysed patient saves lives without antivenom, for weeks if needed (Warrell 2010).
7. Blood still liquid after 20 minutes in clean glass means a dangerous viper bite (Warrell 2010).

8. Cat and hand bites infect most, and antibiotics help hand bites, number needed to treat 4 (Talan 1999, Medeiros 2001).
9. Rabies is fatal once symptoms appear. Without vaccine, wash for 15 minutes and watch the dog 10 days (WHO rabies fact sheet, CDC).
10. Rabies is controlled by vaccinating 70 per cent of dogs (Coleman and Dye 1996).

Open questions

1. True untreated fatality for mambas, kraits, taipans and puff adders. No clean data were found.
2. Whether pressure-immobilisation helps cobra and krait bites in Asia and Africa, and how a healer keeps the skill.
3. Whether, and how fast, to release a tight band in a village with no antivenom.
4. Whether any whole plant preparation reduces death or disability in humans.
5. Whether washing alone reduces human rabies, and by how much.
6. How long human rabies vaccine and immunoglobulin keep potency out of the cold chain.
7. Whether culling dogs without vaccine controls rabies.
8. Whether Bawaskar's prazosin results replicate elsewhere.

Sources to read in full

1. Warrell DA, WHO SEARO snakebite guidelines, 2010 and the 2016 edition (Warrell 2010).
2. WHO Africa snakebite guidelines, 2010 (WHO Africa 2010, not read).
3. Avau B and colleagues, first aid for snakebite, PLoS NTD 2016 (Avau 2016).
4. Gutiérrez JM and colleagues, Snakebite envenoming, Nature Reviews Disease Primers 2017 (Gutiérrez 2017, not read).
5. Warrell DA, Snake bite, Lancet 2010 (Warrell Lancet 2010, not read).
6. WHO rabies position paper 2018 (WHO 2018).
7. Seifert, White and Currie 2011 (Seifert 2011).
8. Medeiros and Saconato, Cochrane 2001 (Medeiros 2001).
9. THRIVING library, WO-02 and WO-03.

At the bedside after the Fall

The household. Minimum viable version: shoes and a light at night, beds off the floor, nets tucked in against kraits. After a snakebite: lie down, keep still, splint, remove rings, do nothing to the wound, carry to the healer. After a dog or cat bite: soap and running water for 15 minutes by the clock, leave open, tie up the dog and watch it 10 days. Remove bee stings at once. Needs: a clock or sand-glass, soap, clean water, cloth, sticks, a stretcher. First failure: the family calls the snake healer first and spends the hours that matter there.

The village of 300. A healer trained in the syndromes, the clotting test, the recovery position and bag or mouth-to-mouth ventilation, with a roster of at least eight adults who have practised relays. A register of bites, dogs and every 10-day dog watch. Clean glass tubes, syringes, bandages in elapid regions, adrenaline if salvaged, paracetamol, soap, a cool dark box for drugs, and a cart team ready. Agreement with local healers to send the bitten to the dispensary first. First failure: the relay team tires on the second night of ventilating a krait victim and someone stops.

The district of 3,000. A nurse or doctor who manages the airway, bag and airway tubes, intravenous fluids, cross-matching and fresh whole blood, fluid charts, and salvaged antivenom stored at 2 to 8°C (liquid) or below 25°C (dried) with adrenaline ready. Salvaged rabies vaccine kept cool and given intradermally, head, face and hand bites first. A dog programme aiming at 70 per cent vaccination when vaccine exists. Records of every bite, species, treatment and outcome. First failure: salvaged antivenom is for the wrong species, or was frozen or warmed until cloudy, and is given anyway.

Protocols

Protocol 1: Snakebite first aid

1. Move away from the snake. Do not try to kill it. A severed head can still bite (Warrell 2010).
2. Lay the person down and tell them most bites are survivable.
3. Remove rings, bracelets and tight clothing from the limb.
4. Splint from the joint below to the joint above the bite, padded with cloth. Sling an arm.
5. No cutting, sucking, burning, ice, rubbing, herbs or tight bands.
6. Elapid regions only, if trained: elastic bandage 10 to 15 cm wide, at least 4.5 m long, from fingers or toes over the whole limb at 50 to 70 mmHg (as tight as for a sprain), then splint. Pulse below must stay present. Or a pad 5 cm square and 2 to 3 cm thick bound firmly over the bite (70 mmHg or more).
7. Carry lying down or propped up. Turn on the side if vomiting.
8. Note the bite time and every change.

Protocol 2: Watching a snakebite (village healer)

1. Every hour for at least 24 hours [VERIFY: duration]: eyelids, swallowing, voice, breathing rate, pulse, bleeding, urine colour and volume, and the ink-marked edge of swelling.
2. Clotting test on arrival and again at 6 hours [VERIFY: interval]: 2 mL of venous blood in clean dry glass, untouched 20 minutes, tipped once. Run a healthy person's blood alongside.
3. Drooping eyelids or failed swallowing: recovery position, call the relay, prepare the bag, send to the district.
4. Liquid blood or bleeding: strict bed rest, no injections, no aspirin, send to the district.
5. Pain: paracetamol 1 g every 4 to 6 hours, maximum 4 g a day for an adult. Child 15 mg/kg per dose [VERIFY].
6. No signs at 24 hours: probably a dry bite.

Protocol 3: Breathing for a paralysed patient

1. Clear the mouth. Recovery position until breathing fails.
2. When breathing fails: tilt the head, lift the jaw and give breaths by bag and mask, or mouth-to-mouth through thin cloth, 10 to 12 a minute for an adult [VERIFY], watching the chest rise.
3. Feel the neck pulse. If present, keep breathing. Ask the patient to move a finger.
4. Relays of one hour each, two people awake at all times, handovers written down.
5. Cobra or unknown snake, if salvaged: atropine 0.6 mg intravenously (child 50 micrograms/kg), then neostigmine 0.02 mg/kg into muscle (child 0.04 mg/kg). If eyelids lift within 30 to 60 minutes, neostigmine 0.5 to 2.5 mg every 1 to 3 hours, maximum 10 mg a day, with atropine (Warrell 2010).
6. Keep going for days if needed.

Protocol 4: Salvaged antivenom (district only)

1. Check species against snake or syndrome. Discard cloudy liquid.
2. Draw up adrenaline 1 mg/mL: 0.5 mL adult, 0.01 mL/kg child.
3. Give antivenom slowly into a vein as labelled.
4. Watch 2 hours. At the first itch, hive, cough, wheeze or fast pulse: stop and give adrenaline into the thigh. Repeat every 5 to 10 minutes if worse.
5. Repeat the clotting test after 6 hours [VERIFY].

Protocol 5: Dog, cat or other mammal bite

1. Wash with soap and running water for 15 minutes by the clock, scrubbing gently and flushing repeatedly. Apply iodine or benzalkonium afterwards if available.

2. Irrigate further with drinkable water as WO-02.
3. Do not close. Only fresh clean face bites may be closed, at the district (WO-03).
4. Hand bites, cat bites, deep punctures: salvaged antibiotics if available.
5. Check at 12 hours for cat bites, 24 hours for dog bites, then daily.
6. Record the animal, owner and bite site.

Protocol 6: Rabies risk without vaccine

1. Wash as Protocol 5.
2. Tie up or pen a known dog or cat with food and water. Do not kill it. Watch it daily for 10 days.
3. If it sickens, changes behaviour or dies, the exposure is real. Any vaccine goes first to this person.
4. If it is well at 10 days, the bite carried no rabies.
5. Wild, fled or destroyed animals count as real exposures.
6. Tell the family honestly: from a rabid dog, roughly one in two for face bites, one in four for hand bites, one in twenty for leg bites, usually appearing in one to three months (Tenzin 2011).
7. Salvaged vaccine: 0.1 mL into the skin at two sites on days 0, 3 and 7. Immunoglobulin, if any, into and around the wound once.

Protocol 7: Bee and wasp stings

1. Remove a bee sting at once by any means.
2. Cold cloth for pain.
3. Swollen lips or tongue, wheeze, faintness or spreading hives: adrenaline 1 mg/mL into the thigh, 0.5 mL adult, 0.3 mL age 6 to 12, 0.15 mL age 6 months to 6 years, repeat at 5 minutes. Lie flat with legs raised unless breathing is easier sitting.
4. More than about 50 stings in an adult, or many in a child: fluids, urine watch for three days, send on if urine darkens or falls.

Protocol 8: Scorpion sting

1. Keep still and calm. Cold cloth for pain.
2. Child stung by a dangerous species: check pulse, breathing and skin every 30 minutes for 24 hours [VERIFY].
3. Sweating, vomiting, cold limbs, breathlessness or frothy sputum: send to the district.
4. District with salvaged prazosin: 30 micrograms/kg by mouth every 3 hours until signs settle, lying down (Pandurang 2014) [VERIFY: single source].

Protocol 9: Marine stings

1. Out of the water. CPR if collapsed.
2. Box jellyfish or bluebottle: vinegar for 30 seconds, then lift tentacles off with a stick or cloth. Not for lion's mane.
3. Bluebottle pain: water at 45°C, tested on the rescuer's elbow, for 20 minutes.
4. Stonefish, scorpionfish or stingray: limb in water at 40 to 45°C for 20 to 30 minutes, longer if pain returns. Remove visible spines. Watch three days for spreading redness.

Numbers to carry

1. **About 50 per cent** of venomous bites are dry (Warrell 2010).
2. **Hours** to death after elapid bites, **days** after viper bites (Warrell 2010).
3. **20 minutes, 2 mL, clean glass**: liquid blood means a dangerous viper bite (Warrell 2010).

4. **50 to 70 mmHg**, sprained-ankle tight, only for paralysing snakes (Warrell 2010, AVRU).
5. **0.5 mg** adrenaline into the thigh for an adult, **0.01 mg/kg** for a child, repeat at **5 minutes** (Warrell 2010, Resuscitation Council UK 2021).
6. **40 minutes**: a tourniquet's limit before gangrene (Warrell 2010).
7. **15 minutes** of washing with soap and water for any bite that might carry rabies (WHO rabies fact sheet).
8. **10 days**: a biting dog that stays well did not carry rabies (CDC).
9. **28 to 2 per cent**: hand-bite infection without and with antibiotics (Medeiros 2001).
10. **45°C** water for venomous fish and bluebottle stings (Queensland Poisons, Loten 2006).

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