



## AUSTRALIAN SNAKEBITE AND SPIDERBITE INFORMATION FOR HOSPITAL LABORATORY STAFF Professor Julian White

**Please use this document in conjunction with your South Australian medical guidelines on snakebite and spiderbite**

### SNAKEBITE

Details of venom actions and venom profiles for each major snake species should be consulted in the main "Snakebite & Spiderbite Management Guidelines South Australia" 2006 document.

Laboratory testing in cases of possible snakebite is crucial in diagnosis and is urgent. Any delay in delivering results may delay definitive and life saving treatment. Frequent repeat testing is almost always required. This is to ensure delayed envenoming or failure to respond to initial treatment is not missed.

### MAJOR LABORATORY TESTS REQUIRED

#### COAGULATION

PT/INR, aPTT, fibrinogen level, d-dimer/FDP, platelet count

#### Defibrination-type coagulopathy

(brown snakes, tiger snakes, rough scaled snake, taipans, broad headed snake group)

*Characterised by grossly prolonged PT and aPTT, undetectable fibrinogen, grossly elevated d-dimer/FDP, platelets normal (sometimes slightly low).*

#### Technical considerations:

Some coagulation machines will have trouble giving results in this situation. If the machine indicates gross prolongation of PT/aPTT, but fibrinogen "very high", this usually indicates undetectable fibrinogen. If d-dimer/FDP is elevated you can be sure fibrinogen will be very low, not very high. **As soon as such a picture is evident immediately report this to the treating doctor. Do not delay while trying to get final results from the machine.** Similarly, if d-dimer/FDP is elevated, report this first, then go back and determine the actual level, which may take time. **Do not waste valuable time retesting and calling for new specimens** because the machine cannot cope with the grossly abnormal results.

Snakebite coagulopathy is common and time is of the essence. So, look for the typical defibrination picture and report this as soon as it is clear that it is present.

Be aware that in mild cases, in the early stages, PT/INR and aPTT may be normal, fibrinogen level normal or only slightly decreased, but d-dimer/FDP will be elevated. This is an important indication of possible developing coagulopathy. However, a similar picture is present in a patient with venous thrombosis problems, so careful clinical judgement will be required by the treating doctor to decide which is the more likely diagnostic explanation.

Another issue to be aware of is the **method of fibrinogen testing** used. The Claus method will give real fibrinogen titres, while the indirect method used in some coagulation machines will be as helpful as it merely mirrors the PT result.

Also, in defibrination coagulopathy after snakebite, **clinicians need to know when the coagulopathy starts to reverse** because this is the crucial end point for antivenom therapy. As soon as the fibrinogen starts to rise, this indicates the circulating procoagulant has been inactivated. Thus, the clinician is not looking for a return to normal fibrinogen levels, which may take > 12 hours, just a slight rise from zero to a low but detectable level.

Many coagulation machines only report fibrinogen levels > 0.65 g/L. This low end cut-off point is far too high to be useful in snakebite. In this situation, a small fall in the PT and aPTT will actually be a better guide.

#### Anticoagulation-type coagulopathy

(mulga snakes, Collett's snake)

*Characterised by mild to grossly prolonged PT and aPTT but normal fibrinogen levels and no significant elevation of d-dimer/FDP.*

#### Patients on Warfarin and similar anticoagulants:

These patients may present a problem in interpreting results if bitten by a snake. Warfarin should cause prolongation of PT in particular, sometimes with elevated d-dimer/FDP, but normal fibrinogen. If snakebite defibrination coagulopathy is overlaid on this background, in most cases, fibrinogen will be depleted and d-dimer/FDP grossly elevated, with an INR of > 4, usually > 10 (actually infinity). This should not cause confusion in interpretation as such a pattern is clearly not due to Warfarin but a result of envenoming.

However, in cases with early or mild snakebite defibrination coagulopathy changes may be subtle. In this setting, significant elevation of d-dimer/FDP may be the most important diagnostic clue that envenoming is occurring.

In cases of snakebite anticoagulation-type coagulopathy, interpretation may be more difficult as elevation of d-dimer/FDP is not a feature. In this setting coagulation tests may not give clear cut evidence of envenoming. Fortunately, in these cases, clinical features and rising CK are likely to assist in diagnosis of envenoming.

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## COMPLETE BLOOD PICTURE

***Platelets, Hb, WCC, absolute lymphocyte count, check for schistocytes***

Acute systemic envenoming usually causes an elevated WCC. Sometimes there may be an associated absolute lymphopenia which can be quite marked. Lymphopenia is always present in tiger snakebites with systemic envenoming but is less consistent for other snake species.

Thrombocytopenia is not a common acute feature of envenoming and when present is often associated with renal damage. In rare cases, especially with brown snakebite, a "TTP" like picture may develop, often after the initial defibrination coagulopathy is responding to antivenom. In such cases there will be a falling Hb, falling platelet counts, rising creatinine and urea, and usually schistocytes on the blood film.

## MUSCLE FUNCTION

### CK

A number of snakes can cause moderate to severe systemic muscle destruction (myolysis): mulga snakes, Collett's snake, tiger snakes, rough scaled snake, taipans, black snakes. This usually takes hours to become evident, occasionally days. Clinically the patient develops muscle pain, weakness and myoglobinuria.

At a laboratory level, CK can become grossly elevated. Significant myolysis is associated with CK levels > 1,000 IU/L and can exceed 100,000 IU/L (sometimes far higher than this). In such cases beware associated hyperkalaemia that can cause lethal cardiac toxicity. Measurement of serum or urine myoglobin levels does not add to the diagnosis, is expensive and treating doctors should be encouraged to use CK levels as the indicator of myolysis rather than myoglobin levels.

## RENAL FUNCTION

### ***Creatinine and urea***

Snakebite can cause renal damage and occasionally renal failure, often secondary to coagulopathy, myolysis, or hypotension. In mild cases, especially with brown snakebite, there may be a slow rise in creatinine and urea over the first few days without polyuric or anuric renal failure which will reverse and gradually improve over a week or so. However, rising creatinine and urea should always be flagged as it may indicate progression to major renal failure.

## ELECTROLYTES

Hyperkalaemia is the major risk, most often in association with myolysis and secondary renal failure. However, hyponatraemia can also develop, most likely in response to over vigorous intravenous fluid replacement.

## LIVER FUNCTION TESTS

LFTs are not routine tests in snakebite cases. Temporary elevation of LFTs sometimes occurs but is rarely of clinical significance. There is no defined picture of envenoming-induced liver damage in humans.

## SNAKE VENOM DETECTION

### CSL SVDK

See "Snakebite & Spiderbite Management Guidelines South Australia" document for details on this test and interpretation.

## SPIDERBITE

Spiderbite does not cause diagnostically useful laboratory test abnormalities and in most cases there will be no need to perform laboratory tests.

The exceptions would be cases of skin injury where infection was suspected, requiring wound swabs and microscopy, or rare cases of severe funnel web spider envenoming with multi organ failure and secondary problems such as coagulopathy and renal failure. In the latter situation, expect results consistent with other causes of such problems. Spiders do not cause envenoming coagulopathy.

## ABBREVIATIONS

|      |  |
|------|--|
| APTT | Activated partial thromboplastin time  |
| CK   | Creatine kinase                        |
| FDP  | Fibrin/fibrinogen degradation products |
| Hb   | Haemoglobin                            |
| INR  | International normalised ratio         |
| PT   | Prothrombin time                       |
| SVDK | Snake venom detection kit              |
| WCC  | White cell count, leucocyte count      |