A Systematic Review of Scorpion Envenomation Therapeutics and Antivenom Accessibility

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Introduction:

- Scorpions (*Scorpiones*) are eight-legged arthropods of the class *Arachnida*
- Increased human migration and transcontinental produce shipment may cause the incidence of scorpion envenomations to increase in non-endemic areas[1]
- We aim to compile existing envenomation prevention and treatment data into a clinical resource to be used at the bedside when encountering Scorpion envenomations

Methods:

For this systematic review:

1. PubMed (NCBI), MEDLINE (OVID), EMBASE (OVID), Cochrane Database of Systematic Reviews (CIDR) and TOXLINE (TOXNET) were searched from inception to March 2022 using combinations of the search terms "scorpion", and "envenomation*"
   - We included: observational studies, case reports, case series, and cohort studies, as well as clinical trials, and antivenom safety, tolerability, and efficacy
   - We excluded: Molecular epidemiology and purely mechanistic pathogenesis studies
2. Abstracts underwent double reviewer screening and only titles about scorpions that had double inclusion responses were included for the full-text review
3. A different pair of authors screened the subsequent full-texts and only double inclusion responses were included in the systematic review. The GRADE approach will be used to assess quality of studies reporting therapeutic interventions[2]. Evidence will be summarized using descriptive measures for each intervention type. Meta-analysis will be planned if sufficient efficacy measures exist

Results:

1. 961 MEDLINE articles, 1053 PubMed, 1486 EMBASE, 0 CIDR and 149 TOXLINE records were retrieved for title and abstract screening; after de-duplication, **1928** remained
2. Following the abstract screening protocol, **692** titles advanced to full-text review
3. Full-text screening resulted in the inclusion of **~90** titles to the systematic review
4. Our analysis captures the reported clinically-relevant data of **529,469 scorpion envenomation victims**
5. Of 1,065 envenomated patients treated with antivenom, **only 134 (12.6%)** developed some **mild reaction or adverse event** due to antivenom usage

Figure 1. PRISMA Flowchart

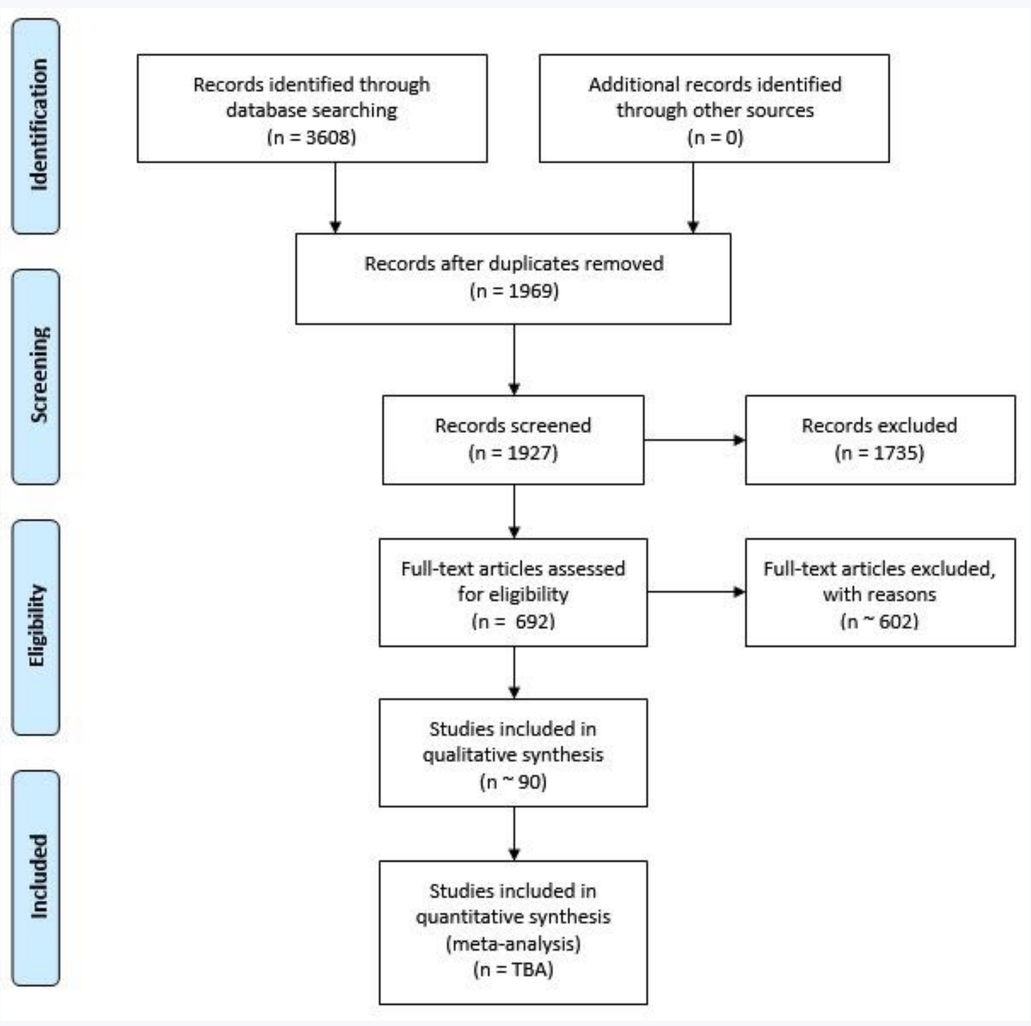

Figure 2. Preliminary qualitative data

Species	Antivenom Adverse Reactions	Pharmacological Treatments
Indian Red Scorpion *(Mesobuthus tamulus)*	• Allergic reactions are possible • Prazosin + Antivenom will reduce the risk of myocardial dysfunction as compared to Prazosin alone	• Hypertension → nifepedipine and prazosin • Tachycardia → prazosin, digoxin, aminophylline, and oxygen • Pulmonary edema → digoxin, aminophylline, furosemide and prazosin • Massive pulmonary edema → nitroprusside as well • Children deteriorate more quickly without antivenom+prazosin, prazosin alone is not enough
Yellow Scorpion (Tityus serrulatus)	• Children with adrenergic manifestations after *T. serrulatus* scorpion sting had significantly lower anaphylactic reactions to antivenom than those without these manifestations • This finding may also be true for adults victims	• Pain at the site of sting → dipyrone & metoclopramide • Shock → intravenous infusion of dobutamine or dopamine • Premedication with epinephrine, antihistamine plus or minus corticosteroid should be given parenterally to patients before antivenom injection to prevent early anaphylactic reactions • Oral analgesics for pain
Centruroides sculpturatus	• Minor vomiting • Some diarrhea • Rare residual amnesia • No acute serum reactions → safe	N/A
Other medically relevant species	***Tityus stigmurus, Tityus obscurus, Hemiscorpius lepturus, Androctonus australis***	

Discussion:

Increased transcontinental movement of people and tropical produce has facilitated importation of arachnids to non-endemic regions where clinicians may lack familiarity with envenomation syndromes and appropriate therapeutics. Synthesizing the current evidence around therapeutic strategies for scorpion envenomations can inform the development of appropriate treatment and prevention protocols

1. Chagla Z, Boggild AK, Chakrabarti S. A venomous visitor from the tropics. The Canadian journal of infectious diseases & medical microbiology = Journal canadien des maladies infectieuses et de la microbiologie medicale. 2015;26(5):243-244.
2. Malmivaara A. Methodological considerations of the GRADE method. *Ann Med*. 2015;47(1):1-5. doi:10.3109/07853890.2014.969766