An Affordable Intraperitoneal Injection Setup for Juvenile and Adult Zebrafish

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Abstract

Intraperitoneal (IP) injections are an effective and reproducible route of drug administration. However, current IP equipment can be either costly, inaccurate, or unsafe for zebrafish. We describe a simple, low-cost IP setup, which can be easily assembled from inexpensive and readily available parts, and which provides a safe, reproducible, and accurate IP-injection method for experimenters.

Keywords: injection setup, intraperitoneal, zebrafish

INTRAPERITONEAL (IP) INJECTION OF zebrafish is considered an effective and reproducible route of administration to study various biological^{1,2} and chemical³ agents. The tools that are currently used to perform IP injections in zebrafish have several limitations. For example, in the case of high-cost equipment they are available only to few, well-funded laboratories. In the case of low-cost alternatives, they have low accuracy, or are not compliant with experimental justifications, are unsafe (leading to fish injuries or to pathogen transfer between specimens), or cannot be applied to a wide range of injection volumes. Here, we describe a simple and low-cost IP injection setup for zebrafish. It addresses some of the shortcomings of other injection assemblies and techniques.

The parts required to assemble the injection rig (Fig. 1A–H) are among the most inexpensive parts and consumables that can be obtained for medical or laboratory needs. The assembly of the injection setup is straightforward (Fig. 1I, and supplement) and the injection procedure with this tool is relatively easy to master and does not require extensive practice to gain proficiency. Moreover, it can be equipped with all types of commonly used needles, including borosilicate glass capillaries that are pulled with an electric or laser puller (thus, the injection apparatus can be used for interorgan injection in transparent mutants of zebrafish, e.g., *casper*^{4,5}) or by hand over a flame. Injections can be performed by a single experimenter, however, for specific applications requiring particular precision or caution (such as using glass capillaries for injection), it is helpful to adopt a two-person protocol. The injection assembly can be used as a disposable tool, or can also be reused, including the tips. Finally, a range of volumes can be administered, for example, the assembly presented in this study can be used to inject volumes as little as 1.5 μ L.

The injection technique with our low-cost tool is shown in Figure 1J–N. The IP injection process can be performed in less than 3–4 min. The evaluation of injection success is similar as in previously published high-cost equipment in other studies.⁶ We injected 41 fish and considered the lack of (1) mortality, (2) bleeding at the injection site, (3) leaking of injection solution from the abdominal perforation immediately after injection, and (4) abnormal behavior after injection and during recovery as key criteria to evaluate the success of injections. We observed no mortality, nor bleeding at any of the injection sites injected with injection solution (5–10 μ L drawing ink, Czech Rep./EU, www.koh-i-noor.cz, in 500 μ L phosphate-buffered saline) during the month after injection or later. We also did not observe any injection solution leaking from the abdominal perforation immediately after the injection tip was withdrawn. Lastly, we observed no abnormal behavior after injecting fish and during their recovery. See also Supplementary Data (Supplementary Data are available online at www.liebertpub.com/zeb) for details.

FIG. 1. Components and the completed injection setup, fish containers, and injection procedure. (A–H) The parts from which the injection tool is assembled. (I) The finished injection setup. (J) Charging of the injection setup with solution. (K) 24-hour, short-term housing containers for fish. (L) Anesthesia and recovery containers. (M) Blotting of fish before injection on medical gauze. (N) Positioning of fish in dorsal recumbency in a soft, slit sponge and injection, anterior to pelvic fin base, after removal of scales.

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Disclosure Statement

No competing financial interests exist.

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