

JET ANESTHESIA AND JET LOCAL ANESTHESIA FOR THE 21ST CENTURY

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The introduction of the hollow needle and glass syringe in the middle of the 19th century was one gigantic step in the progress of medicine to the current state of art. However, the needle with the pain it causes, became the source of fear for many patients. Indeed, immunization of millions of people who feared the needle, against the deadly contagious diseases, would not have been possible without the introduction of a jet-injector, the Med-E-Jet (Peace Gun), a pain-free way of delivering immunizing medication. (*J Natl Med Assoc.* 2002;94:1004-1006.)

Key words: needle ♦ syringe ♦ injection ♦ jet-injector ♦ Med-E-Jet

After returning from military service in World War II, a military surgeon, Dr. Robert Hingson, came to the realization that the epidemics of smallpox and other deadly contagious diseases would result in a larger number of casualties in the second part of the past century than the war. On a TV talk show, he suggested the possibility of making a CO₂-driven jet injector, capable of delivering injections seconds apart with the speed of a machine gun to the billions of people who needed immunizations. One of the prerequisites was that it should be practically pain free.

Fortunately, a viewer of the show, the wife of an inventor by the name of Banker, mentioned it to her husband the next morning. And so, Mr. Banker indeed succeeded with the development of the Med-E-Jet injector used in the immunization of more than one billion people during the following two decades. This big accomplishment was made possible only with the support of the US Public Health Services, the public health services of participating countries, the generosity of thousands of volunteer physicians and

nurses, and four US presidents, as well as many foreign heads of state.

The pivotal role in the Brother's Brother Foundation, which Dr. Hingson founded in the 60s, cannot be emphasized enough. Hingson predicted that a well-organized and well-conducted immunization campaign should lead to the eradication of all contagious diseases from the face of the Earth by the end of the past century. Indeed, by 1990, no more epidemics of smallpox were reported from the Center for Disease Control.

The advantages of the jet injection immunization have been well established in the past 50 years. Although Hingson envisioned anesthetic induction with jet injection, he did not have at his disposal anesthetic drugs that could have been used by the Med-E-Jet injector. The only potential drug, ketamine, when used alone intramuscularly, caused hallucinations and other unwanted side effects. However, if its administration was preceded by diazepam (Valium), most of the adverse side-effects of ketamine could be prevented. Although, diazepam could not be given by jet-injection, since it was not water-soluble. Introduction of its water-soluble derivative,

midazolam (Versed), allowed us to test it with the Med-E-Jet in children.

Both midazolam and ketamine provided rapid, reliable, and safe induction of anesthesia in children.^{1,2} Both drugs reached the circulation faster by jet-injection than by any other route of administration, except intravenous. It is well accepted that most children have a fear of the needle, whereas the jet-injected children in our studies experienced no fear, no pain, and no unpleasant recall.^{3,4}

Another breakthrough was made shortly after the successful induction of jet anesthesia in children: the creation of a local anesthetic wheal with zero pain scores.⁵ In contrast, lidocaine given with a small needle, which is currently used routinely, caused pain rated from 2 to 7 on a zero to 10 pain-rating scale. After the jet injection of a lidocaine skin wheal, subsequent intravenous catheterization caused zero pain. This finding means that any time a patient has to undergo an iatrogenic procedure such as blood taking; intravenous injection or catheterization; puncture through the skin for sternal, spinal, epidural, or caudal punctures; or, injection of drugs through the skin, the pain of the needle can be circumvented by using jet local anesthesia. Whole hospitals and doctors' offices can be made pain-free from iatrogenic procedures.

PERSPECTIVES

The current success of the design of jet-injector syringes, which are disposable and relatively inexpensive, will lead to worldwide use of jet-injection techniques of anesthesia and local jet anesthesia of the skin. The multiple advantages of a new JI syringe are: the initial high cost of jet injectors is eliminated; no needles are used for filling the JI syringe or to inject the patient; therefore, no transmission of infection to the patient from healthcare workers, or vice versa, can occur.

Jet injection causes practically no pain or stress reaction; hence, multiple injections can be given over several hours to patients undergoing ambulatory surgery, with little or

no discomfort. Once the JI syringe is used and emptied of CO₂ gas, it cannot be reused by addicts.

The reduction in AIDS and hepatitis-C epidemics can be achieved by the needle-less syringes. In 98% of all iatrogenic procedures, JI syringes could be used in lieu of the needle/syringes. Furthermore, the jet-injection technology will help to control the current pandemic of needle-stick injuries.

In the United States alone, more than 1 million needle-stick injury cases were reported in the past year, including injuries to healthcare workers. The average cost of a needle-stick injury ranges from \$500 to \$2500. The US Congress passed a law against needle-stick injuries, which mandates the use of devices that are safer than the conventional needle and syringe. By using needle-free jet syringes, the risk of needle-stick injuries is prevented. And since jet-injection causes no pain, healthcare workers also can comply with the mandates of JCAHO to reduce the pain in patients to a minimum and record it in writing. Ultimately, needle-free, infection-free, and pain-free hospitals and health care may soon be achieved, thereby circumventing patients' fear of needles, hospital-acquired infections, and pain associated with many procedures. The end result would be a more humane medical experience for all patients.

DISCLOSURE

The author states that he has no financial interest in any medical manufacturer or drug company and has received no remuneration for the use of any jet-injector or jet syringe. In the past seven years since his retirement, he says he has conducted all research on jet anesthesia and jet local anesthesia as a non-salaried courtesy staff member without any institutional or grant support.

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