

Vaccine and Needle-Free Vaccination Delivery System

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Abstract

Needle-free injection delivery system is a new method use a unique profile to deliver vaccine to the proper tissue depth for injection. The shift from needle-based to needle-free immunization is also catalyzed, in part, by the realization that skin, which can increase vaccine immunogenicity, is ideal target for vaccine delivery. As a promising delivery of vaccines system, it has the potential to decrease the dose of vaccine antigen, enhance immune response and may furthermore help to reduce costs.

Keywords: Immunization; Skin; Jet injection; Immunogenicity

Introduction

Needles and syringes are the most commonly used immunization procedures, associated with avoidance and phobic behaviors in a large proportion of people [1]. Needle phobia makes immunizations stressful, moreover needle-stick injury [2,3], improper and unsafe use, such as re-use of needle or syringe cause transmit blood-borne pathogens lead to large number of HBV, HCV and HIV cases, are serious problems in all countries [4]. However, the development of needle-free injection methods has now been identified as an important goal to prompt global health care [5]. It is a highly flexible technology holds much potential using various techniques, including an instrument delivers a high speed liquid vaccine stream into skin or target regions. In the future, this new vaccination technology may make needles redundant [6].

Skin is an interest target and an alternative site for vaccine delivery [7,8], not only because of the ease of access, but also its unique immunological properties. Skin vaccine methods have been tested in many clinical trials, such as rabies [9], hepatitis B [10] and influenza vaccines [11]. In the case of the influenza vaccine, Richard [12] compared the immunogenicity of intradermal immunization with standard intramuscular immunization. They reported that the viability of a dose-sparing strategy involving intradermal injection with a fraction of the intramuscular dose, one fifth of a standard intramuscular dose of antigen is equivalent or comparable to the full dose [12]. It has both cellular and humoral immune system components. Thus far, as the gatekeeper and barrier of the immune systems, it efficiently elicits both innate and adaptive immune responses and improved long term protection [13]. The central group of immune cells involved innate immune response is dendritic leukocytes, Langerhans cells and dendritic cells [14-17]. All of them as members of the family of antigen-presenting cells act as both the first line to interact with incoming pathogen, and play a pivotal role as messengers that are able to alert adaptive immune response against pathogens and antigens [18]. Since naïve T and B cells rely on the innate immune system to sense infectious events. The antigen-presenting cells capture and process the antigen entering the skin, and re-express part of it as peptide/MHC complex on the surface are also profoundly affected by danger signals or danger signal-induced cytokine [19]. In a word, deliver vaccine directly to the APCs can enhance the vaccine potency via strategies that modify the properties of antigen-presenting cells. On the contrast, when the use of needle based injections of vaccine deliver the antigen to the muscle region is thought to be a limited space that contains little numbers of antigen-presenting cells and stimulate weak response.

According to the above definition, the characteristics, structural

and cellular make-up enable skin is quite significant for vaccination. Nonetheless, it cannot be effectively accessed by conventional needles due to the lack of simple and reliable technologies. Furthermore, the fact that only part of volumes of fluid vaccine can be injected precisely. As the possible routes for immunization, the technologies for needle-free injection delivery system administration of vaccines through the skin, is suitable for all ages and both genders.

Needle-free injection delivery system is a new method use a unique profile to deliver vaccine to the proper tissue depth using driving force for injection [20]. When compared with needles, the methods showed multiple benefits [21]. It can be less painful, so it would increase acceptability and reduce needle stick injuries would enhance occupational safety for minimally trained personnel. This could be particularly significant in the future should it become necessary to consider how they might conduct mass immunization campaigns rapidly. In order to deal with the threat, needle-free technologies, for example a single-use nozzle jet injector that can reduce the risk of splash back of blood and reduce the dose of vaccine, the factors become necessary when vaccine shortage such as a pandemic influenza or bioterrorism emergency, also could simplify immunization schedules. However, some studies have reported that this technology have been associated with more frequent local-reaction, including bruising, redness, swelling of the injection site. In addition, improper use of the needle-free injection devise can cause the vaccine are not able to accurately inject into the skin, or can lead to the immediate pain.

Indeed, several publications investigating genetic vaccines have demonstrated that route via skin of administration results in typical higher efficacy. More recently, vaccine dose-sparing by delivery using needle-free technologies is well established in clinical practice for Inactivated Poliovirus Vaccine (IPV). This evaluation well document that vaccinating infants with a single fractional dose of IPV can induce priming and sero-conversion in more than 90% of immunized infants [22]. Moreover, we know that DNA vaccine immunogenicity has

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been limited by inefficient delivery [23]. Needle-free devices have also successfully delivered DNA vaccines in clinical trials pointed that this is a promising method for stimulating gene expression and immune response owing to the presence of Langerhans cells [24,25].

Vaccines are one of the most cost-effective preventive methods for controlling the infectious diseases. And the needle-free injection system can propel liquid vaccine (live or nonliving) into the skin, due to the kinetic energy of a high velocity vaccine jet. The development of effective strategies for skin vaccination without the 'sharps', immunization practice would become safer, more economical and more suitable would revolutionize immune. Cost of immunization also is a critical factor when we need to accept a new method. Cutting the dose cannot decrease the response, it was thought to be a reasonable approach if vaccine happened to be in short supply and make routine vaccination affordable for use in all countries [22]. It is hoped that this new method will lower the economic burden and ease the logistical burdens of immunization programs [26]. In addition to scientific and immunological concerns, it has the potential to improve both the logistics and immunology of vaccine. The skin represents an excellent site for vaccine inoculation due to its natural role and the high local frequency of antigen presenting cells that serve to amplify immune response. Advantages in needle-free injection delivery system have attracted lots of researchers and businesses to the field of vaccine development. Overall, this system can be acted as a technological innovation that would remove a critical barrier to solving an important health problem in worlds.

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