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## Original Research Article

# Ready-to-use devices for intraosseous injections (BIG) in the practice of Emergency Medical Teams in the city and county of Poznań – Primary survey



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## ABSTRACT

**Introduction:** Intraosseous (i.o.) access using a bone injection gun (BIG) is an efficient alternative to intravenous access, ensuring rapid infusion of fluids and medications. Intraosseous access is achieved through a ready-to-use BIG device allows for the delivery of fluids at flow rates up to 125 mL/min, and for performing basic laboratory tests.

**Aim:** The aim of this paper was to assess the knowledge of and scope of application for ready-to-use BIG devices among the members of Emergency Medical Teams from the District Emergency Station in the city and county of Poznań.

**Material and methods:** The survey was carried out in March and April 2013. Survey results were analyzed using Statistica 10.0 software, Polish version (analysis of statistical significance with the  $\chi^2$  test and  $\chi^2$  test incorporating Yates' correction at  $\alpha = 0.05$ ).

**Results:** Respondents had positive results regarding the use of BIG devices, which they had acquired during a number of specialist courses.

**Discussion:** Despite this fact, BIG devices are rarely used during rescue operations in the city and county of Poznań, Poland and most frequently used in situations when achieving intravenous access is impossible within times shorter than 1 minute.

**Conclusions:** The results also confirmed that BIG devices are available in operations carried out by the ambulance Emergency Medical Service.

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## 1. Introduction

The procedure for intraosseous (i.o.) access was developed in the early 20th century. It was used in the 1920s and during World War II, which was confirmed by about 4000 reports

prepared at that time.<sup>1</sup> Currently, the implementation of advanced life-saving operations is associated with many difficulties in the pre-hospital setting, when circumstances are unfavorable, weather conditions are harsh or the environment hostile. Establishing venous access is one of the major operations carried out in casualties with sudden

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circulatory arrest. It is particularly important in pediatric patients with life-threatening conditions when obtaining intravenous (i.v.) access is often very difficult due to anatomical reasons. Establishing i.v. access is also difficult in patients where more than 2 minutes have elapsed when attempting during cardiopulmonary resuscitation (CPR). In these cases i.o. access should be considered.<sup>2</sup>

Intraosseous access is established by making an injection directly into the bone marrow space using a specially designed device. This is an alternative measure for delivering drugs and fluids when access to the peripheral veins is difficult or impossible. Drugs delivered through i.o. infusion achieve plasma levels in a time comparable to drugs delivered through the i.v. route. The needle insertion and thus establishing contact with the bone marrow space takes only 20 seconds or so. With correctly established i.o. access a flow rate of up to 125 mL/min can be achieved. In addition, it allows for collecting specimens in laboratory tests, such as blood typing, gasometry, blood count, hemoglobin or electrolyte levels.<sup>3,4</sup>

Intraosseous access is usually established in the proximal part of the tibial bone (near the tibial tuberosity), or in the distal part, near the medial ankle. Other penetration sites used for injection include the humeral bone head, radial bone or femoral bone.<sup>5</sup> Intraosseous access is contraindicated in patients with fractures or other injuries at the potential penetration site, as well as those with symptoms of infection in this part of the body. There is always a risk of complications that may occur when establishing i.o. access. The most frequent complications include hematoma, inflammation and bone fractures. Intraosseous access should not last longer than 24 hours, and should be discontinued as soon as peripheral or central i.v. access has been established.

## 2. Aim

The aim of this paper is to assess the knowledge of and scope of application for ready-to-use BIG devices among members of Emergency Medical Teams (EMT) from the District Emergency Station in the city and county of Poznań, Poland. Such a study has never been carried out in Poznań so far.

## 3. Materials and methods

The survey was carried out in March and April 2013 among the members of the basic and specialist EMT operating within the system of Public Emergency Medicine in the city and county of Poznań. The survey was carried out based on an original questionnaire concerning the use of BIG devices in everyday practice during rescue operations.

Survey results were analyzed using Statistica 10.0 software, Polish version (analysis of statistical significance with the  $\chi^2$  test and  $\chi^2$  test incorporating Yates' correction at  $\alpha = 0.05$ ).

### 3.1. Characteristics of the study group

The study group included 81 subjects (73% men, 27% women). In total, 47% of respondents were under 31 years of age, 36% were 31–40 years old, and 17% were over 40 years old. Most

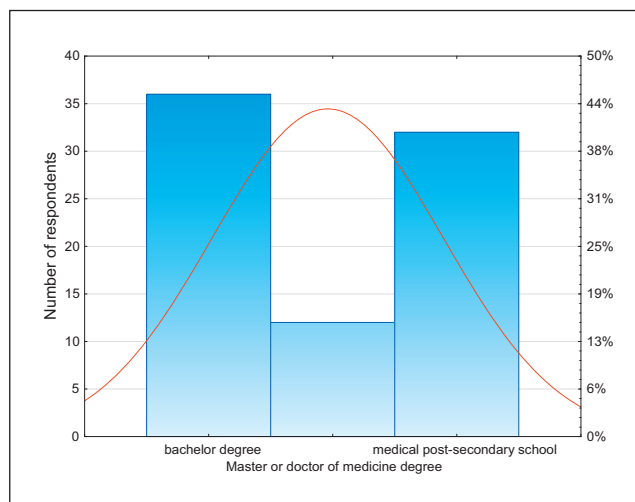


Fig. 1 – Education of respondents.

respondents were paramedics (80%), followed by subjects with an educational background in nursing (12%), and medical doctors (8%). With respect to the education of the EMT members, 46% of respondents had a bachelor degree, 39% had completed education in a medical post-secondary school, and 15% of respondents had a Master or doctor of medicine degree. Figure 1 presents the distribution of respondents by education, expressed in percent and number.

Most respondents (about 95%) worked in Wielkopolskie province. Respondents worked in cities with populations over 500 000 (35%), towns or cities with populations between 10 000 and 500 000 (50%), and only 15% worked in rural areas and small towns (up to 10 000 population); 22% of surveyed members of EMT had work experience longer than 4 years, 61% of respondents had experience between 5 and 10 years, and 17% had worked in their profession for longer than 10 years.

## 4. Results

All respondents had knowledge of BIG devices. In total, 51% of respondents declared to have access to BIG devices at all times when they were needed, 39% had a limited number of devices, 7% did not know if BIG devices were a part of ambulance equipment, and 3% declared that such devices were unavailable to them.

Respondents declared they acquire knowledge on establishing i.o. access from self-education (25%), specialist medical courses (e.g. ALS, ACLS, ITLS, PHTLS, EPLS, PASL) (23%), post-secondary school/higher degree studies (23%), in-house training organized by the employer (10%), or training received at more than one center (7%).

Figure 2 presents the distribution (in number and percentages) of the sources of knowledge on BIGs among respondents.

About 63% of all respondents (59% women and 64% of men) correctly indicated at least two sites for establishing i.o. access when presented with a diagram of the patient's body. There was no statistical correlation between the sex of EMT members and knowledge on the injection site for BIG ( $P = 0.7095$ ).

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