

DOI: <https://doi.org/10.36489/saudecoletiva.2020v10i59p4272-4285>

Advantages and limitations of the use of intra-bone access in emergencies and emergencies: integrative review

Ventajas y limitaciones del uso del acceso intra-óseo en emergencias y emergencias: revisión integrativa

Vantagens e limitações do uso do acesso intraósseo nas urgências e emergências: revisão integrativa

ABSTRACT

Objective: To describe the main advantages and limitations of using intraosseous access in urgencies and emergencies. **Methods:** This is an integrative review, which used articles available in the Virtual Health Library, specifically in the databases of Latin American and Caribbean Literature in Health Sciences and MEDLINE, and in the Scientific Electronic Library Online, in the period of august 2016 to october 2016. **Results:** 292 articles were found, and 31 of them were initially selected. After the exclusion criteria, 9 articles were obtained as a final sample, grouped according to the author, year of publication, title, objective, type of study and results. **Conclusion:** It was clear that this is a simple learning technique and its complications are insignificant. It has been shown to be used safely in different puncture sites, both in adults and children. Therefore, it is hoped that this study may prompt further research on the subject.

DESCRIPTORS: Emergencies; Emergency nursing; Intraosseous infusions; Methods.

RESUMEN

Objetivo: Describir las principales ventajas y limitaciones de utilizar el acceso intraóseo en urgencias y emergencias. **Métodos:** Es una revisión integradora, que utilizó artículos disponibles en la Biblioteca Virtual en Salud, específicamente en las bases de datos de Literatura Latinoamericana y Caribeña en Ciencias de la Salud y MEDLINE, y en la Biblioteca Científica Electrónica en Línea, en el período de agosto de 2016 a octubre de 2016. **Resultados:** Se encontraron 292 artículos, de los cuales 31 fueron seleccionados inicialmente. Tras los criterios de exclusión, se obtuvieron 9 artículos como muestra final, agrupados según autor, año de publicación, título, objetivo, tipo de estudio y resultados. **Conclusión:** quedó claro que esta es una técnica de aprendizaje simple y sus complicaciones son insignificantes. Se ha demostrado que se utiliza de forma segura en diferentes sitios de punción, tanto en adultos como en niños. Por lo tanto, se espera que este estudio impulse más investigaciones sobre el tema.

DESCRIPTORES: Emergencias; Enfermería de emergencia; Infusiones intraóseas; Métodos.

RESUMO

Objetivo: Descrever as principais vantagens e limitações do uso do acesso intraósseo nas urgências e emergências. **Métodos:** Trata-se de uma revisão integrativa, que utilizou artigos disponibilizados na Biblioteca Virtual em Saúde, especificamente nas bases de dados da Literatura Latino-Americana e do Caribe em Ciências da Saúde e MEDLINE, e na Scientific Electronic Library Online, no período de agosto de 2016 a outubro de 2016. **Resultados:** Foram encontrados 292 artigos, e feita à seleção de 31 deles inicialmente. Após os critérios de exclusão, obteve-se como amostra final 09 artigos, agrupados de acordo com o autor, ano de publicação, título, objetivo, tipo de estudo e resultados. **Conclusão:** Ficou claro de que se trata de uma técnica de simples aprendizado e suas complicações são insignificantes. Demonstrou ser usado com segurança em diferentes locais de punção, tanto em adultos quanto crianças. Sendo assim, espera-se que este estudo possa suscitar novas pesquisas sobre a temática.

DESCRIPTORES: Emergências; Enfermagem em emergência; Infusões intraósseas; Métodos.

RECEIVED ON: 08/29/2020 APPROVED ON: 10/23/2020



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INTRODUCTION

We live in constant evolution, using technology in favor of improving the health conditions of the population. Urgent and emergency care has been highlighted by the large number of care of the most varied types. It is pointed out that, in the metropolitan regions, the main causes of death, in the age group between 15 and 49 years, are trauma from accidents, cases of poisoning and violence. ⁽¹⁻²⁾ Currently, more than six billion reais are spent on hospital and outpatient services, and more than one billion on prophylactic and therapeutic support in Brazil. ⁽³⁾ The state of Minas Gerais has an expenditure of approximately R \$ 354 million annually executed in ur-

gency and emergency, highlighting the regions of the South of Minas Gerais, which spends more than 79 million, and the Central region, with expenditure of more than 75 million. according to surveys conducted in 2015. ⁽⁴⁾

Obtaining a route for administering fluids and medications is essential in urgent and emergency care, and accesses such as the peripheral intravenous route may not be possible depending on several factors that involve the patient. Another option would also be central access, however it is not recommended due to the delay in establishing it. ⁽⁵⁻⁷⁾

Due to the ease and minimal risk of complications, the peripheral intravenous route remains the first option in cases of urgency, and after not established with three attempts in the short term

according to the latest Guidelines of the American Heart Association (AHA) on Cardiopulmonary Resuscitation (CPR) and Cardiovascular Emergency Care (CEC), the intraosseous route is the second most efficient option, as it is a fast procedure that lasts an average of 10 to 20 seconds and its contraindications are only the presence of fracture or other trauma in the local insertion, prosthetic joint, previous puncture attempts, osteoporosis or other abnormalities, such as infection at the site. ⁽⁸⁻⁹⁾

First described in 1922 by Drinker ⁽¹⁰⁾, was replaced by Josefson ⁽¹¹⁾ in 1934, in pediatric emergencies. In the 1940s, it started to be used more frequently due to the Second World War, falling, soon after, in disuse, with the technological advance and the appearance of new cathe-

ters. ⁽¹²⁻¹³⁾ In 1980, it gained prominence again, being used more often in children and adults, considering that the intraosseous access provides a rigid, non-collapsible pathway in the medullary cavity of long bones, for the infusion of fluids and medications. ⁽¹⁴⁾

There are different devices for performing intraosseous access that are commercially available and easy to use. The most used are the Driver (EZ-IO), the BIG and the Fast (impact device) that works as an injection gun. The EZ-IO, approved by the Food and Drug Administration in 2004 ⁽¹⁵⁾, recently been used in a prehospital environment ⁽¹⁶⁾, It can be used with different lengths of needles and meters for placement in children and adults. ⁽¹⁷⁾ Despite the ease of access and having the necessary material, studies on the intraosseous route highlight, mainly, the concern of pre-hospital insertions and the lack of skills necessary to perform this procedure. ⁽¹⁸⁾

The councils responsible for supervising the professional activities of nurses consider that they have legal competence to perform the intraosseous puncture procedure, however, they consider that performing the intraosseous puncture procedure is considered a complex procedure related to the context of care in urgent situations and emergency, recognizing that their technical training is essential. Thus, it is considered lawful that in situations of urgency and emergency and aiming at the preservation of life, the nurse professional performs the intraosseous puncture procedure. ⁽¹⁴⁾

In this perspective, this study will bring important contributions to this professional category, reflecting in the safer execution of the intraosseous puncture procedure and consequently increasing the quality and effectiveness of adult and pediatric care. In view of the relevance of the subject addressed, the objective of this study was to describe the main advantages and limitations of the use of intraosseous access in urgencies and emergencies.

METHODS

It refers to an integrative review study, carried out from bibliographic surveys in academic databases, which seeks to provide an effective analysis of results in order to contribute to the topic addressed and to practice. It is characterized by five stages, namely: the identification of the research question; establishment of inclusion and exclusion criteria; data analysis; evaluation of studies and presentation of results. ⁽¹⁹⁾

In general, for the construction of the integrative review it is necessary to go through six distinct stages, similar to the stages of development of conventional research. ⁽¹⁹⁾ In view of this, the following steps were used to analyze and select the articles: formulation of the guiding question: (What are the advantages and limitations of using intraosseous access in urgency and emergency?); criteria for inclusion and exclusion of studies; definition of the information to be extracted from the selected studies; evaluation of studies included in the integrative review; interpretation of results; presentation of the review.

The database search was carried out from August 2016 to October 2016. The study consisted of articles from the internet and articles from the international literature were published, published in Portuguese, English or Spanish, using the abstracts available at the Library Virtual Health (VHL), specifically in the databases of Latin American and Caribbean Literature in Health Sciences (LILACS) and MEDLINE, and in the Scientific Electronic Library Online (SciELO) according to the protocol "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA). ⁽¹⁹⁾

The selection of studies was carried out by two researchers, in independent searches. In case of disagreement, a third author was consulted and the final decision was taken by consensus. In order to ensure methodological rigor, the DeCS (Descriptors in Science and Health) were consulted for the selection of terms, with

the following combination being defined as the search equation: Pregnancy (Unplanned OR Unwanted) AND Breastfeeding.

The descriptors used were ("Infusions, Intraosseous/adverse effects"[Mesh] OR "Infusions, Intraosseous/contraindications" [Mesh] OR "Infusions, Intraosseous/history" [Mesh] OR "Infusions, Intraosseous/instrumentation" [Mesh] OR "Infusions, Intraosseous/methods" [Mesh] OR "Infusions, Intraosseous/nursing" [Mesh] OR "Infusions, Intraosseous/organization and administration" [Mesh] OR "Infusions, Intraosseous/pharmacology" [Mesh] OR "Infusions, Intraosseous/standards" [Mesh] OR "Infusions, Intraosseous/statistics and numerical data" [Mesh] OR "Infusions, Intraosseous/therapeutic use" [Mesh] OR "Infusions, Intraosseous/therapy" [Mesh] OR "Infusions, Intraosseous/trends" [Mesh] OR "Infusions, Intraosseous/veterinary" [Mesh]) AND ("Infusions, Intraosseous/adverse effects" [Majr:noexp] OR "Infusions, Intraosseous/contraindications" [Majr:noexp] OR "Infusions, Intraosseous/history" [Majr:noexp] OR "Infusions, Intraosseous/instrumentation" [Majr:noexp] OR "Infusions, Intraosseous/methods" [Majr:noexp] OR "Infusions, Intraosseous/nursing" [Majr:noexp] OR "Infusions, Intraosseous/standards" [Majr:noexp] OR "Infusions, Intraosseous/statistics and numerical data" [Majr:noexp] OR "Infusions, Intraosseous/trends" [Majr:noexp] OR "Infusions, Intraosseous/veterinary" [Majr:noexp]).

The following inclusion criteria were used: articles in Portuguese, Spanish or English; original articles, available and free, that contained one or more descriptors, published from 2006 to 2016 and that fit the topic addressed. Repeated articles, which were published before 2006, that did not fit the chosen theme were excluded.

As a search strategy for the articles, the PICO tool was used, which is an instrument based on scientific evidence. The PICO method can be used to build

Chart 1 - Description of the Pico strategy - Itaúna, Minas Gerais, 2016

Acrônimos	DESCRIÇÃO	ANÁLISE
P	Paciente	Pacientes vítimas de situações de urgências e emergências
I	Intervenção ou indicador	Acesso Intraósseo
C	Comparação ou controle	Não se aplica
O	Outcomes – desfecho	Evidenciar as vantagens e limitações do uso do acesso intraósseo nas urgências e emergências

Source: Rev. Latino-am Enfermagem, 2007⁽²⁰⁾.

Chart 2 - Exclusion Criteria

CRITÉRIO DE EXCLUSÃO	QUANTIDADE DE ARTIGOS EXCLUÍDOS
Artigos Repetidos	04
Artigos Incompletos	05
Artigos que não atenderam aos objetivos	08, sendo 03 destes sobre estudos em animais.
Artigos que os dados já haviam sido analisados em outras referências	05

Source: Authors, 2016.

Chart 3 - References included in the integrative review

Nº	TÍTULO	AUTOR/ANO DE PUBLICAÇÃO	TIPO DE ESTUDO	RESULTADOS
1	Intraosseous Access	Hans Rosenberg BSc MD, Warren James Cheung BHSc MD / 2013	Estudo observacional	Dois lactentes foram admitidos na unidade neonatal com dificuldade venosa, foram ressuscitados com êxito de episódios de colíose usando o acesso intraósseo.
2	Intraosseous Emergency Access by Physicians Wearing Full Protective Gear	Ron Bem – Abraham, MD, Ilan Gur, MD, Youri Vater, MD, and A. Weinbroum, MD. / 2003	Estudo Experimental	A aplicação d BIG foi testada 20 vezes, tendo sucesso em 80% das tentativas realizadas de forma rápida e segura, obtendo resultado eficaz.
3	Resuscitation in Massive Obstretic Haemorrhage Using Intraosseous Needle	D. J. Chatterjee, B. Bukunda, T. L. Samuels, L. Induruwage and D. R. Uncles / 2011	Relato de Caso	O sucesso do acesso neste caso baseou-se em um elemento chave do processo inicial de ressuscitação, que foi a utilização da agulha intraóssea.
4	Recommendations for the use of intraosseous vascular access for emergent and noneemergent situations in various health care settings: a consensus paper. Crit Care Nurse.	Phillips L, Brown L, Campbell T, Miller J, Proehl J, Youngberg B. / 2010.	Análise de Literatura	A evolução tecnológica dos dispositivos intraósseos torna o procedimento relativamente fácil de se executar com educação e formação adequadas.
5	Intraosseous Devices for Intra-vascular Access in Adult Trauma Patients	Michael W. Day, RN, MSN, CCRN / 2011	Estudo Comparativo	A via intraóssea foi consistentemente ser um meio rápido e confiável de obtenção do acesso vascular, no sucesso da ressuscitação.

research topics of different natures, originating from the clinic, from the management of human and material resources, from the search for tools for symptom assessment, among others. The appropriate (well-constructed) research question allows for the adequate definition of what information (evidence) is essential for the resolution of the clinical research question. ⁽²⁰⁾ The synthesis of the data through the PICO strategy is shown below in Table 1.

Through this search method, 292 articles were found, and 31 of them were initially selected. The exclusion criteria were then performed, as described below in Table 2.

RESULTADOS

After the analysis, 08 articles were obtained as a final sample, grouped as shown in Table 3 below.

6	An Observational, Prospective Study to Determine the Ease of Vascular Access in Adults Using a Novel Intraosseous Access Device	Ong, Marcus EH, Adeline SY Ngo, and Ramesh Wijaya / 2009	Estudo Observacional	Os resultados dos dispositivos mesmos com suas limitações vivenciadas foram de sucesso, comprovando o tempo médio de colocação do BIG em 100% e EI-Zo em 87%.
7	A theoretical alternative intraosseous infusion site in severely hypovolemic children	Mogale, Nkhensani, Albert-Neels Van Schoor, and Marius C. Bosman / 2015	Estudo de caso com exploração anatômica em cadáveres.	Com base nos dados anatômicos coletados, é provável que seja uma alternativa segura, quando a agulha é inserida conforme o método discutido.
8	Complicación de la vía intraósea en un neonato	Carreras González, E. / 2012	Estudo de Caso	A punção intraóssea é a via de escolha mais segura e apropriada em relação à ressuscitação infantil, quando se desempenha um papel importante em permanecer por um tempo mínimo possível.

Source: Authors, 2016.

DISCUSSION

The texts found were read, organized and synthesized in 05 thematic categories, namely: Pediatric Intraosseous Access; Adult intraosseous access, locations and types of devices; Competencies of the Doctor and the Nurse.

Pediatric intraosseous access

In 1922, Drinker already proposed, according to studies, the use of intraosseous access in newborns and children, due to risk situations and appropriate procedures without complications. Current technology and studies allow the infusion in the intraosseous route to be considered the safest and most effective way, when compared with failures or impossibilities of intravenous, central and umbilical accesses.⁽²¹⁾ The difficulty of the infusion is perceived due to the non-insertion of the peripheral access⁽²²⁾, or even resistance due to the small lumen gauge for fast flow.⁽²³⁾

With that they discovered that, with the intraosseous access, injectable fluids enter with a much more satisfactory rate in the circulation. The place of first choice is the upper third of the tibia or the third of the femur, because there are no muscles involved, the sternum bone should not be chosen in children aged 3 to 5 years, as it has a greater risk of reaching the heart or other organs.⁽²⁴⁾

Since these bone structures are firm, the needle does not move, even with excessive patient movements or pre-hospital transport, and there is no discomfort in the slow infusion, only if the fluid is at a higher pressure, where there may be an increase in intramedullary pressure.⁽²³⁻²⁵⁾

Therefore, we know the accuracy of a safer and more available route of fluid administration in children and long bones indicate a successful route, not affecting their growth and offering ease, agility, safety and few complications that are not considered objections to not using this method.⁽²⁴⁾

Intraosseous access in adults

As well as the pediatric procedure, the use of the intraosseous route in adults was widely used during the Second World War in 1940, falling out of use until the 1980s, when it started to be used more frequently⁽²¹⁾, this pathway provides a significant effect that is decisive in cases of advanced life support⁽²⁷⁻²⁸⁾ where the access is inserted through long bones (humerus, tibia, femur, sternum), which has a cavity with a higher concentration of bone marrow and is not constricted.^(21, 26-28)

With the analysis of studies carried out by AHA and the international resuscitation association, Intraosseous access is recommended as a standard intervention after attempts of traditional

methods of intravenous access such as peripheral, jugular and central, of difficult or impossible to obtain, being that they are separated according to the patient's priority.^(23, 29)

The insertion of the intraosseous access is done in less than one minute and can be administered in a flow of approximately 125 ml per minute of fluids, and resuscitating medications such as atropine, epinephrine and adrenaline with the same dosage as when they are made intravenously, can blood products such as plasmas, insulins, sulfonamides (antimicrobials), penicillin (antibiotics), antitoxins, as well as analyzes of blood samples.^(23, 24) The access time is 24 hours, which is necessary for volume replacement and stability for puncture of an intravenous route.⁽²³⁾

However, one should not forget the risks and disorders that are presented at the time of the procedure, such as pain, infections or bleeding, which should not be excluded as complaints in adults, however the effectiveness must be considered as one of the best beneficial methods already studied. for the treatment of patients and for the reduction of imminent risks.^(21, 28)

Device types and locations

Three intraosseous devices have been approved by the Food And Drug Administration for use in trauma pa-

tients where intravenous access requires a long time for insertion or is totally impossible due to the hypovolemic state.⁽²³⁾

The BIG (BIG injection gun) can be used on the tibia and proximal humerus, its handling is done by manual pressure, small and light device, available in blue for adults and red for children, with a recommended penetration depth of 2,5 cm for adults, for children from 0 to 3 years old, 0,5cm to 0,7cm, pediatric from 3 to 6 years old, 1,0cm to 1,5cm, and pediatric from 6 to 12 years old, 1,5cm. It has good fixation, which facilitates the transport of patients, manufactured in Israel by WAISMED, arrived in Brazil in 2007. It consists of a device with a long spring that is fired after removing its lock, it also has a regulator for the application site or by age group and is a disposable device.^(23, 29)

The EZ-IO can be used in the proximal tibia, distal tibia and proximal humerus, it is a pistol-type equipment (drill) operating on battery with a set of three needles with different and disposable sizes. The device can be sterilized after use, there is a great difference over insertion where there is excess tissue, with good fixation. Manufactured in the United States of America by the company VIDA CAREN.^(23, 29)

FAST 1 is used strictly in the region of the sternum bone, a place that may require the use of both hands to exert the necessary pressure. It is activated by a manual application, a light and small device, manufactured in Canada by the company PYNG MEDICAL. It has an

Tintroducer with different needles for application.^(23, 29)

Competencies of the doctor and the nurse

After studies of the articles, it was analyzed that medical professionals and nurses are qualified to perform the technique of intraosseous puncture, however, they are still small due to the lack of knowledge about it.⁽²⁸⁾

Doctors are more likely to perform such a procedure, as they have careful knowledge of indication and advantages. One of its interventions is the change in behavior and the recognition of the nurse as a qualified professional in conducting the technique and other emergency situations. The nurse, in turn, has the necessary training to perform patient care, using, where appropriate, intraosseous access as the route chosen in the situation, where it contributes to the prevention of delays in care.^(8, 28)

According to the Resolution of the Regional Nursing Council of São Paulo (Coren-SP), the Intracosseous Puncture by Nurses is the competence of the doctor and the nurse, who work in urgent and emergency services, the execution of this procedure, if necessary, in a safe and fast, providing a time saving service and improvements in the patient's prognosis. CTA 006.95 considers that the technique performed by nurses in pediatric emergencies is favorable, and new scientific studies have proved that it is also performed in adults, thus allowing it to be performed by nurses, provided that they are properly trained and that

they perform their role with competence, honesty, justice and responsibility, always ensuring quality nursing care and without damage.⁽¹⁴⁾

The professional must also ensure that the institution in which he works has protocols that ensure all of his actions in relation to each service provided, that both are followed correctly by the entire team and that all actions performed are recorded in the medical records, clearly and objective, as described in its code of ethics.^(8, 28)

We can conclude that the trained nurse is qualified to perform the technique of intraosseous access in any emergency situation, as long as he/she has adequate training, in order to guarantee better patient care.

CONCLUSION

Intraosseous access is used to ensure a faster route of effective administration of fluids and medications when there is an obstacle in obtaining peripheral venous access. This technique of intraosseous venous access needs to be disseminated and used more, as it is a simple and easy procedure. Rapid intervention in difficult venous access in emergency situations is most often a determinant for the maintenance of human life.

Thus, it is hoped that this study may prompt further research on the subject, as well as demonstrate to nurses who work in Urgency and Emergency about its important role in intraosseous venous access and the prognosis in a real situation becomes more favorable. ■

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