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Review Article

The state of the art on hypodermoclysis in child health care: scoping review

O estado da arte sobre hipodermóclise na assistência à saúde da criança: revisão de escopo

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Isabella Pavarine de Souza[1]
Maria Paula Custódio Silva[1]
Ana Letícia Ribeiro Oliveira[1]
Giselle Vieira de Souza[1]
Jesislei Bonolo do Amaral Rocha[1]
Divanice Contim[1]

[1]Universidade Federal do Triângulo Mineiro. Uberaba, MG, Brazil.

Corresponding author:
Maria Paula Custódio Silva
Rua Frei Paulino, 30, Abadia,
CEP: 38025180. Uberaba, MG, Brazil.
E-mail: maria_paulacs@hotmail.com

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ABSTRACT

Objective: to mapping the evidence on hypodermoclysis in child health care. **Methods:** this is a scope review, with a search in Medical Literature Analysis and Retrieval System Online, Latin American and Caribbean Health Sciences Literature, Cochrane Library, Cumulative Index to Nursing and Allied Health Literature, Scopus Elsevier, Web of Science and Embase. Studies published in Portuguese, English and Spanish were included, with no time cut. **Results:** a total of 11 studies were analyzed, with a predominance of literature reviews. The main themes were: use of recombinant human hyaluronidase as a facilitator of subcutaneous absorption; comparison between subcutaneous and intravenous rehydration; advantages of hypodermoclysis; patient pain and puncture attempts. **Conclusion:** this study allowed mapping the scientific evidence on hypodermoclysis, revealing it to be a viable and valid alternative for administering medications in children. **Contributions to practice:** the use of the technique can bring benefits and provides evidence to indicate and apply it in child care.

Descriptors: Hypodermoclysis; Child Health; Nursing.

RESUMO

Objetivo: mapear as evidências sobre hipodermóclise na assistência à saúde da criança. **Métodos:** trata-se de uma revisão de escopo, com busca nas bases *Medical Literature Analysis and Retrieval System Online*, Literatura Latino-Americana e do Caribe em Ciências da Saúde, Cochrane Library, *Cumulative Index to Nursing and Allied Health Literature*, Scopus Elsevier, Web of Science e Embase. Incluíram-se estudos publicados em português, inglês e espanhol, sem recorte temporal. **Resultados:** foram analisados 11 estudos com predomínio de revisões de literatura. Os principais temas foram: uso da hialuronidase humana recombinante como facilitadora da absorção subcutânea; comparação entre a reidratação subcutânea e intravenosa; vantagens da hipodermóclise; dor do paciente e as tentativas de punção. **Conclusão:** este estudo permitiu mapear as evidências científicas sobre hipodermóclise, revelando ser uma alternativa viável e válida para administrar medicamentos em crianças. **Contribuições para a prática:** o uso da técnica pode trazer benefícios e fornece evidências para indicá-la e aplicá-la na assistência à criança.

Descritores: Hipodermóclise; Saúde da Criança; Enfermagem.

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Introduction

The blood vessels of pediatric patients have smaller caliber and due to capillary fragility can make it difficult to visualize and palpate when performing the puncture; especially in younger children and/or hospitalized for chronic processes, which require continuous care[1]. Several variables such as palpation, visibility, skin tone and prematurity may constitute failure in the first attempt of intravenous puncture. Besides the anatomical and physiological topography as important components in the procedure characterized as invasive, indicating the need for additional resources[2].

Among the access options in children, hypodermoclysis stands out for its ease of insertion and handling, promotion of comfort and autonomy, as well as reduced risk of local or systemic complications[3]. Thus, this technique is a possible access route in patients who need clinical support, fluid, drug or electrolyte replacement, in an intra or extra-hospital environment, intermittently or continuously[4]. In an attempt to reduce the risks compared to a central venous access, hypodermoclysis has been used in several national and international health institutions, as a valuable resource for the administration of medicines and solutions[3-4].

It is noteworthy that the absorption of large volumes of solutions infused through this procedure is mediated in the blood and lymph capillaries of the hypodermis due to the action of hydrostatic and osmotic forces, allowing the infused solution to continuously occupy the vascular spaces[5]. However, there are restrictions on the absorption of certain medications and limited volume of fluids to be administered[6]. This technique has proven to be comfortable, with less risk of congestion, infection, and electrolyte disturbances, and has a better cost-benefit ratio than other routes of drug administration in non-emergency situations, because it is considered simple to use and easy to handle by caregivers and family members at home, and by health professionals in hospitals[6-7].

Although indicated, there are limitations to its use in children due to lack of evidence, still little known and used by the pediatric nursing team[8-9], justifying the need for reliable studies that support the efficacy and applicability of hypodermoclysis in children. It is noteworthy that in adults and the elderly the technique is widely disseminated and used[5].

Therefore, subcutaneous therapy offers therapeutic strategies for the process of care related to drug administration, in order to substantiate the knowledge, support and guide professionals regarding the use in different therapeutic environments. Thus, the objective was to mapping the evidence on hypodermoclysis in child health care.

Methods

The study is a scoping, systematized, and exploratory review. This type of review seeks to map and identify the relevant scientific production in a given area. It was developed based on the recommendations of the international guide Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist[10], in the method proposed by the Joanna Briggs Institute, Reviewers Manual[11] and structured in five steps[12]. The research protocol was written by the authors and registered in the Open Science Framework (osf.io/asqgv).

The first step, based on the Participants, Concept and Context (PCC) strategy[11] for the construction of the research question, in which P Participants) - children, C (Concept) - the hypodermoclysis and C (Context) - use of hypodermoclysis in children, the following guiding question was developed: What is the scientific evidence on the use of hypodermoclysis in children?

The second step consisted of a search, carried out in October 2021, in the Medical Literature Analysis and Retrieval System Online (MEDLINE) databases, through the US National Library of Medicine National Institutes of Health (PubMed) search engine, in the Latin American and Caribbean Literature on Health

Sciences (LILACS), through the Virtual Health Library (VHL), in the Cochrane Library, in the Cumulative Index to Nursing and Allied Health Literature (CINAHL), in Scopus Elsevier, in the Web of Science, and in Embase. In addition, a manual search of the references from the articles was performed. The search strategy was defined based on the Descriptors in Health Sciences (DeCS), Medical Subject Headings (MeSH), CINAHL Heading and Emtree of the Embase Index, and to broaden the search, the descriptors were combined using the Boolean operators OR and AND, Figure 1 shows the search syntax according to the databases used.

Data base	Strategy
LILACS/BVS	MH: Hypodermoclysis OR (Hypodermoclysis) OR (Hypodermoclysis) OR MH:E02.319.267.510.795.500$ OR MH:E02.319.360.500$ AND MH:Child OR (Child) OR (Child) OR (Niño) OR (Children) OR (Children) OR (Niños) OR MH: M01.060.406$
PubMed/MEDLINE	(("Hypodermoclysis"[Mesh] OR (Subcutaneous Hydration) OR (Hydration, Subcutaneous) OR (Subcutaneous Fluid Administration) OR (Administration, Subcutaneous Fluid) OR (Fluid Administration, Subcutaneous)) AND ("Child"[Mesh] OR (Children)))
COCHRANE; Web of Science	Child OR (Children) AND Hypodermoclysis OR (Subcutaneous Hydration) OR (Hydration, Subcutaneous) OR (Subcutaneous Fluid Administration) OR (Administration, Subcutaneous Fluid) OR (Fluid Administration, Subcutaneous)
CINAHL; SCOPUS	Child OR children AND Hypodermoclysis OR Subcutaneous Hydration OR Hydration, Subcutaneous OR Subcutaneous Fluid Administration OR Administration, Subcutaneous Fluid OR Fluid Administration, Subcutaneous
EMBASE	'Child'/exp OR child AND 'hypodermoclysis'/exp OR (hypodermoclyses) OR (subcutaneous fluid administration) OR (subcutaneous hydration)

Figure 1 – Article search syntax. Uberaba, MG, Brazil, 2022

Each database has its own particularities, and the strategies were adapted according to the base, keeping the proposed combinations. The databases were accessed using the Journal Portal of the Coordination for the Improvement of Higher Education Personnel, through the Federated Academic Community (CAFe), and the studies were exported to the Rayyan Software[13] to assist in the selection.

Studies were included that addressed hypodermoclysis in children, published in Portuguese, English and Spanish, without time limit and excluded the expert opinion and the letter to the editor. The third step was the reading of titles and abstracts and the application of selection criteria, and then the selected articles were read exhaustively in full, according to the guiding question, by two researchers independently, if there was no consensus, there was the evaluation of a third.

Data extraction from the selected studies constituted the fourth step, performed by a structured instrument in Microsoft Excel 2010®, following a script for data collection, namely: first author, year of publication and country of origin, journal that was published, study design and sample, and the main results. The last step consisted in summarizing and analyzing the data extracted from each selected article, which were entered into electronic spreadsheets. Since this is a review study that does not involve human beings, it was not submitted to the Research Ethics Committee.

Figure 2 presents the search and selection process according to the recommendations of the Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist[10].

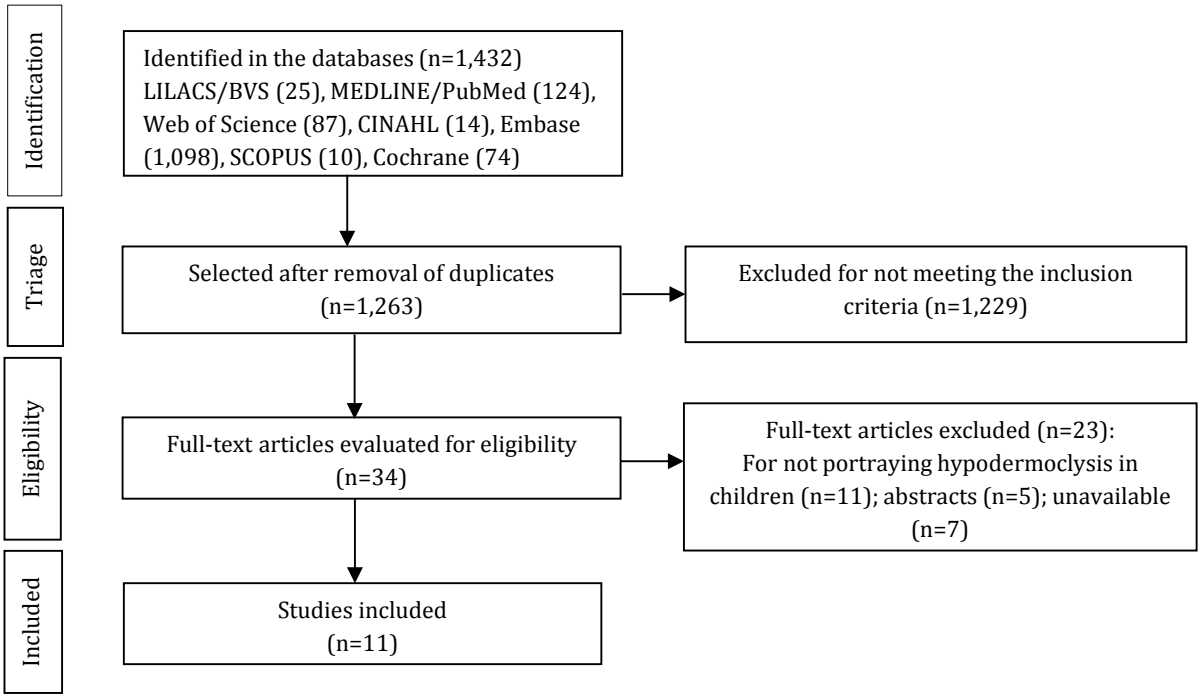

Figure 2 – Flowchart of selection of studies identified in the PRISMA recommendations. Uberaba, MG, Brazil, 2022

Results

The search strategy identified a total of 1,432 publications. After exclusion of 169 duplicates and 1,229 by established eligibility criteria, 34 studies were selected for reading in full, excluding those that definitely did not meet the research question, or were not available, resulting in a total of 11 studies included in the review.

Of the studies included, literature reviews predominated five (45.4%), mostly from the United States of America (USA), eight (72.7%), followed by one publication from Brazil (9.1%), one from France (9.1%) and another from Kenya (9.1%), three (27.2%) of the publications occurred in 2019 and two (18.1%) in 2010. The main topics addressed were, the use of recombinant human hyaluronidase, facilitating subcutaneous absorption, comparison between subcutaneous rehydration and intravenous therapy, and the advantages of hypodermoclysis in children with mild to moderate dehydration, calling into question patient pain and puncture attempts. The main characteristics of the selected manuscripts are described in Figure 3.

Authors/ Year/Country	Journal	Objective	Study design/ sample	Main results
Weinstein et al. 1982/ USA[14]	Blood	Compare continuous subcutaneous infusions of cytosine arabinoside (ara-C) with continuous intravenous infusions.	Prospective cohort study Eight children, aged four to 14 years.	The intravenous infusions and continuous subcutaneous infusions were similar in the two routes of administration, however, the subcutaneous infusions take longer to reach the desired concentration time, the subcutaneous infusions can be administered on an outpatient basis, thus avoiding the need and expense of hospitalization.

(the Figure 3 continue in the next page...)

Authors/ Year/Country	Journal	Objective	Study design/sample	Main results
Pershad 2010/ EUA[15]	Appl Health Econ Health Policy	To examine the available literature on cost and analyses for the three available routes of rehydration therapy in adults and children.	Systematic review. Six articles.	In patients with mild to moderate dehydration, subcutaneous infusion therapy may offer cost savings and solutions for parenteral fluid administration.
Rouhani et al. 2010/EUA[16]	Pediatrics	To analyze the efficacy, benefits, and risks of alternative techniques to pediatric rehydration, namely nasogastric, intraosseous, intraperitoneal, subcutaneous, and proctocolonic rehydration.	Narrative review. Three articles.	Pain during the use of hyaluronidase-facilitated hypodermoclysis was verified in children with mild to moderate dehydration and failure of the technique and ineffectiveness for the treatment evaluated. In one, the child developed oliguria and edema three days after placement of the subcutaneous infusion access and the symptoms were attributed to the technique.
Spandorfer et al.2012/ EUA[17]	Clin Ther	Evaluate whether subcutaneous rehydration facilitated by hyaluronidase can be performed safely and effectively, with volumes similar to those delivered intravenously, for children with mild to moderate dehydration.	Randomized controlled trial. 148 children with mild to moderate dehydration from one month to ten years.	Subcutaneous infusion provides an effective and well-tolerated route to rehydration for children with mild to moderate dehydration, is less invasive and easier to perform; compared to intravenous infusion, it requires less staff time and the number of unsuccessful puncture attempts was lower.
Kuensting 2013/EUA[18]	J Emerg Nurs	Review the timing of subcutaneous fluid initiation for children with mild to moderate dehydration, and document the number of puncture attempts.	Retrospective descriptive study. 36 medical records of children from two weeks to five years.	Subcutaneous infusions achieved a shorter time to onset of parenteral rehydration, fewer attempts, and a 100% puncture success rate with the use of hyaluronidase. Administration by this route recreated an alternative method of fluid distribution for children with mild to moderate dehydration.
Marikar et al. 2014/EUA[19]	Arch Dis Child Educ Pract Ed	Compare the effectiveness of using subcutaneous rehydration instead of intravenous fluids.	Systematic review. Four studies.	Hyaluronidase-facilitated subcutaneous infusion may be an alternative in the impossibility of intravenous access, but no study has compared the use of subcutaneous infusion fluids alone against intravenous fluids.
Concklin 2016/EUA[20]	J Vasc Access	Assessing subcutaneous fluid distribution in pediatric patients.	Experience report. 13 children.	A 100% success rate on the first attempt at subcutaneous infusion access was reported, and can be a bridge to patients whose intravenous access is impossible to obtain.
Pouvreau et al . 2017/ França[21]	Arch Pediatr	Investigating the comfort advantages of subcutaneous therapy in neonatal palliative care settings.	Systematic review and experimental study. Six studies and 66 neonatal units; 17 regional teams average of 35 beds per unit.	The subcutaneous infusion route is an interesting route in terminal palliative management in the neonatal period for some indications.
Saganski et al. 2019/ Brasil[5]	Cogitare Enferm	To describe the use of hypodermoclysis in unconventional pediatric treatments.	Integrative review. Six articles.	Hypodermoclysis is a technique well tolerated by pediatric patients, justified due to the decrease in pain intensity and the protection from stress for the child, family and nursing staff.
Zubairi et al. 2019/ Quênia[22]	Pediatr Emerg Care	To evaluate the feasibility of implementing the hyaluronidase facilitated subcutaneous technique in rural Western Kenya.	Quantitative-qualitative prospective cohort study. 51 children older than two months with mild to moderate dehydration.	Hyaluronidase facilitated subcutaneous infusion is an effective method for severely dehydrated children in settings with limited resources for intravenous access, most caregivers were satisfied with what was provided by the therapy.
Wheaton et al. 2019/ EUA[23]	J Infus Nurs	To demonstrate a new approach to hydration of critically ill pediatric patients with difficult venous access.	Case Report. A child.	Subcutaneous infusions can perform safely and tolerably to provide hydration and treatment of mild to moderate dehydration in children with difficult venous access.

Figure 3 – Presentation of the articles included in the review. Uberaba, MG, Brazil, 2022

Discussion

The hypodermoclysis technique brings advantages in the therapy of solution and drug administration to pediatric patients, being less uncomfortable and considered simple[15,20-21], can reduce stress and anxiety[24-25], bringing more comfort to the pediatric patient[26]. The understanding of the lancing technique, care, indications, its advantages and disadvantages is of utmost importance for efficient patient care, as well as the dissemination of this knowledge through continuing education[27].

This procedure is considered safe and effective in the treatment of mild to moderate dehydration in children, and is a viable alternative with good compliance because it reduces vascular, mechanical and painful trauma, and has a high success rate[3,5]. The technique is viewed positively by professionals, children, and their parents[17,22], and is better tolerated when compared to the intravenous route, because it has better control of discomfort at the puncture site[28].

The human recombinant hyaluronidase enzyme (rHuPH20) was cited in most of the selected studies as being a facilitator in the absorption of subcutaneous fluids, developed and described as of 1940, has a 24-48 hour duration period, after which the tissue returns to normal. In 2005 the enzyme rHuPH20 was developed and approved by the Food and Drug Administration, for use in subcutaneous hydration in children and adults[17,29].

The manual for the use of the subcutaneous route in pediatrics, was published in Brazil in 2019 by the National Academy of Palliative Care, highlights: indications and contraindications for use; the description of the hypodermoclysis technique; positioning the catheter in the direction of lymphatic drainage; proper puncture site; catheter type, dressing change, the medications and solutions safe for subcutaneous use[30]. Thus the additional benefits in terms of ease of use and cost-effectiveness of subcutaneous access in clinical guidelines, seek to promote the adoption of this route to help preserve the vessel health of vulnerable patients[31]. However, it is clear that in practice there is a limitation of the medications indicated, making off-label use necessary. This pharmacological terminology refers to a drug prescribed or administered in a way that is different from what is recommended in the package insert, whether in the route of administration, dose, age group, or treatment indicated. It is noteworthy that in pediatric patient care it is a common practice to use drugs with these characteristics[32].

Dehydration in children is one of the main life-threatening situations[22], hypodermoclysis was indicated as a facilitator in offering parenteral fluid rehydration in children, performed with fewer punctures, providing more timely treatment compared to the time and insertion of intravenous therapy, reducing the length of the child's stay in the emergency room. On average, upon request, hypodermoclysis was started within 20 minutes (Standard Deviation (SD): 5-35 minutes), compared to intravenous attempts, which had an average infusion delay of 1.5 hours (SD: 45-255 minutes)[20].

Parents and caregivers considered the use of hypodermoclysis satisfactory or very satisfactory (94.5%) in the children they used for treatment, compared to intravenous therapy (73.3%)[17]. It is known that the child is frightened when having to undergo procedures, such as intravenous puncture, and is not always cooperative due to fear, trauma, and anxiety[24]. Subcutaneous puncture minimizes these feelings by causing less pain and being less invasive, besides offering greater comfort to the child[33].

The preparation of the child for these stressful moments in hospitalization or treatment is essential and the use of strategies helps in the explanations and demonstrations of procedures, allowing the child to understand what is going to happen, and thus, face the moment with more confidence and less anxiety[24].

It is known that prolonged treatment in palliative care or chronic diseases, whether in adults or children, increases capillary fragility, making venipuncture more difficult, and hypodermoclysis may

be indicated as a technique of greater comfort[5,26]. In children there are still restrictions due to the need for studies to examine the use of subcutaneous infusion in pediatrics[20], and training of professionals to perform the procedure[4]. A review by the American Society for Enteral and Parenteral Nutrition on the use of hypodermoclysis revealed that its use in children with cancer was effective for fluid replacement for hydration and nutrition[5].

Another indication found in the literature is for the use of continuous insulin infusion in children with Type I Diabetes Mellitus, and the child himself can be trained to self-application, aiming to build autonomy. The use of continuous insulin was associated with fewer punctures and parental anxiety; however, it is a high-cost resource that is difficult to reach for the general population[34].

Continued education practices must be encouraged and promoted by nurses in order to disseminate the correct use of the technique in the various contexts of care[26]. It is the duty of the nursing professional to participate in the educational processes of the institutions, as instructed in the Code of Ethics of Nursing Professionals, in order to develop skills and improve the quality of health care for the patient and society[33].

Study limitations

The hypodermoclysis is characterized as a developing theme in scientific production, with few experimental studies with robust designs, which limited the search for evidence on its implementation in practice. The studies in this review were small randomized clinical trials or observational studies, thus alluding to the need for studies with greater methodological rigor in order to better understand the use of hypodermoclysis in children.

Contributions to practice

The findings of this review are relevant for health professionals working in child care, because it is a technique that causes less discomfort and pain, and can be used in various contexts, being considered easy to insert and handle, which brings comfort to the patient. The Nursing team, for having daily contact with patients, must be able and integrated to methods that can bring benefits, such as hypodermoclysis, and the nurse, as a health educator, must develop strategies to raise awareness of the whole team and disseminate theoretical and practical knowledge about the technique.

Conclusion

This study allowed mapping the scientific evidence on hypodermoclysis in children, revealing to be a viable and valid alternative to administer medications in children, which causes less pain and discomfort compared to intravenous therapy, considered effective in mild and moderate rehydration. It is understood that the use of scientific evidence in care practice is of paramount importance, studies on hypodermoclysis in children are scarce, requiring research to produce greater evidence on the subject.

Authors' contributions

Conception and design, data analysis and interpretation, manuscript writing and critical review of intellectual content: Souza IP.
Conception and design and critical review of the intellectual content: Silva MPC, Contim D.
Analysis and interpretation of data and critical review of intellectual content: Oliveira ALR.
Relevant critical review of the intellectual content: Souza GV, Rocha JBA.
Final approval of the version to be published: Souza IP, Silva MPC, Contim D, Souza GV, Rocha JBA.
Agreement to be responsible that all aspects of the manuscript related to the accuracy or completeness of any part of the work are properly investigated and resolved: Souza IP, Silva MPC, Oliveira ALR, Souza GV, Rocha JBA, Contim D.

References

1. Silva MEA, Reichert PS, Souza SAF, Pimenta EAG, Collet N. Chronic disease in childhood and adolescence: family bonds in the healthcare network. Texto Contexto Enferm. 2018;27(2):e4460016. doi:https://dx.doi.org/10.1590/0104-070720180004460016
2. Freire MHS, Arreguy-Sena C, Müller PCS. Cross-cultural adaptation and content and semantic validation of the Difficult Intravenous Access Score for pediatric use in Brazil. Rev Latino-Am Enfermagem. 2017;25:e2920. doi: https://doi.org/10.1590/1518-8345.1785.2920
3. Vidal FKG, Oselame GB, Neves EB, Oliveira E. Hypodermoclysis: sistematic review of literature. Rev Atenção Saúde. 2015;13(45):2953. doi: https://doi.org/10.13037/ras.vol13n45.2953
4. Azevedo DL, Fortuna CM. O uso da via subcutânea em geriatria e cuidados paliativos: um guia da SBGG e da ANCP para profissionais [Internet]. 2017 [cited Nov 28, 2021]. Available from: https://sbgg.org.br//wp-content/uploads/2017/11/SBGG_guia-subcutanea_2aedicao.pdf
5. Caccialanza R, Constans T, Cotogni P, Zaloga GP, Pontes-Arruda A. Subcutaneous infusion of fluids for hydration or nutrition: a review. J Parenter Enteral Nutr. 2018;42(2):296-307. doi: https://doi.org/10.1177/0148607116676593
6. Gomes NS, Silva AMB, Zago LB, Silva ECL, Barichello E. Nursing knowledge and practices regarding subcutaneous fluid administration. Rev Bras Enferm. 2017;70(5):1155-64. doi: https://dx.doi.org/10.1590/0034-7167-2016-0424
7. Martins SB, Cordeiro FR, Zilmer, JGV, Arrieira ICO, Oliveira OT, Santos C. Perceptions of family caregivers about the use of hypodermoclysis at home. Enferm Actual Costa Rica. 2020;38:103-20. doi: https://dx.doi.org/10.15517/revenf.v0i38.38509
8. Ramos FT, Alencar RA. Hipodermóclise na administração de fluidos e medicamentos em crianças. Rev Recien. 2021; 11(34):394-404. doi: https://doi.org/10.24276/rrecien2021.11.34.394 -404
9. Saganski GF, Freire MHC, Peses AL, Gusso AK, Morais SRL, Migoto MT. Hypodermoclysis for unconventional pediatric treatments: an integrative review. Cogitare Enferm. 2019;24:e61546. doi: http://dx.doi.org/10.5380/ce.v24i0.61546
10. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:71. doi: https://doi.org/10.1016/j.ijsu.2021.105906
11. Aromataris E, Munn Z. JBI manual for evidence synthesis. The Joanna Briggs Institute [Internet]. 2020 [cited Nov 13, 2021]. Available from: https://jbi-global-wiki.refined.site/space/MANUAL
12. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19-32. doi: http://dx.doi.org/10.1080/1364557032000119616
13. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan – a web and mobile app for systematic reviews. Syst Rev. 2016;5:210. doi: https://dx.doi.org/10.1186/s13643-016-0384-4
14. Weinstein HJ, Griffin TW, Feeney J, Cohen HJ, Propper RD, Sallan SE. Pharmacokinetics of continuous intravenous and subcutaneous infusions of cytosine arabinoside. Blood. 1982;59(6):1351-3. doi: https://doi.org/10.1182/blood.V59.6.1351.bloodjournal5961351
15. Pershad J. A systematic data review of the cost of rehydration therapy. Appl Health Econ Health Policy. 2010;8(3):203-14. doi: https://dx.doi.org/10.2165/11534500-000000000-00000
16. Rouhani S, Meloney L, Ahn R, Nelson BD, Burke TF. Alternative rehydration methods: a systematic review and lessons for resource-limited care. Pediatrics. 2011;127(3):748-57. doi: https://doi.org/10.1542/peds.2010-0952
17. Spandofer PR, Mace SE, Okada PJ, Simon HK, Allen CH, Spiro DM, et al. A randomized clinical trial of recombinant human hyaluronidase-facilitated subcutaneous versus intravenous rehydration in mild to moderately dehydrated children in the emergency department. Clin Ther. 2012;34(11):2232-45. doi: https://doi.org/10.1016/j.clinthera.2012.09.011
18. Kuensting LL. Comparing subcutaneous fluid infusion with intravenous fluid infusion in children. J Emerg Nurs. 2013;39(1):86-91. doi: https://doi.org/10.1016/j.jen.2012.04.017

19. Marikar D, Reynolds C, Rich J. Question 1: Are subcutaneous fluids a viable alternative to intravenous therapy in rehydrating children with gastroenteritis and moderate dehydration. Arch Dis Child Educ Pract Ed. 2014;99(8):783-5. doi: https://doi.org/10.1136/archdischild-2013-305735

20. Concklin F. Subcutaneous infusion-'the new hydration station'. J Vasc Access. 2016;21(4):258. doi: https://doi.org/10.1016/j.java.2016.10.053

21. Pouvreau N, Tandonnet J, Tandonnet O, Renesme L. Use of subcutaneous route for comfort care in neonatal palliative population: Systematic review and survey of practices in France. Arch Pediatr. 2017;24(9):850-9. doi: https://dx.doi.org/10.1016/j.arcped.2017.06.009

22. Zubairi H, Nelson BD, Tulshian P, Fredricks K, Altawil Z, Mireles S, et al. Hyaluronidase-assisted resuscitation in Kenya for severely dehydrated children. Pediatr Emerg Care. 2019;35(10):692-5. doi: http://doi.org/10.1097/PEC.0000000000001183

23. Wheaton T, Schlichting C, Madhavarapu S, Koncicki M. A novel use of long-term subcutaneous hydration therapy for a pediatric patient with intestinal failure and chronic dehydration: a case report. J Infus Nurs. 2020;43(1):20-2. doi: https://doi.org/10.1097/NAN.0000000000000350

24. Lima LN, Carvalho EO, Silva VB, Melo MC. Experiência autorelatada da criança hospitalizada: uma revisão integrativa. Rev Bras Enferm. 2020;73(4):20180740. doi: https://doi.org/10.1590/0034-7167-2018-0740

25. Caleffi CCF, Rocha PK, Anders JC, Souza AIJ, Burciaga VB, Serapião LS. Contribution of structured therapeutic play in a nursing care model for hospitalised children. Rev Gaúcha Enferm. 2016;37(2):e58131. doi: https://dx.doi.org/10.1590/1983-1447.2016.02.58131

26. Souza TCF, Correa Júnior AJS, Santana ME, Carvalho JN. Pediatric palliative care: analysis of nursing studies. Rev Enferm UFPE online [Internet]. 2018 [cited Nov 13, 2021];12(5):1409-22. Available from: https://periodicos.ufpe.br/revistas/revistaenfermagem/article/download/231901/28900

27. Bezerra ACP, Morais GSN, Queiroz XSBA, Carneiro AD, Neto JRG, Castro LHP. Understanding nursing professionals about the benefits and complications of hypodermoclysis in patients affected by cancer. Rev Eletr Acervo Saúde. 2021;13(1):5083. doi: https://doi.org/10.25248/reas.e5083.2021

28. Mason JA, Robertson JD, McCosker J, Williams BA, Brown SA. Assessment and validation of a defined fluid restriction protocol in the use of subcutaneous desmopressin for children with inherited bleeding disorders. Haemophilia. 2016;22(5):700-5. doi: https://doi.org/10.1111/hae.12949

29. Allen CH, Etzwiler LS, Miller MK, Maher G, Mace S, Hostetler MA, et al. Recombinant human hyaluronidase-enabled subcutaneous pediatric rehydration. Pediatrics. 2009;124(5):e858-67. doi: https://doi.org/10.1542/peds.2008-3588

30. Ferreira EAL, Ramos FT, Polastrini RTV. Uso da via subcutânea em pediatria ANCP [Internet]. 2019 [cited Nov 28, 2021]. Available from: http://imunoped.fmrp.usp.br/wp-content/uploads/sites/461/2019/12/Manual-de-Hipoderm%C3%B3clise-em-Pediatria_FINAL.pdf

31. Broadhurst D, Cooke M, Sriram D, Gray B. Subcutaneous hydration and medications infusions (effectiveness, safety, acceptability): a systematic review of systematic reviews. PLoS One. 2020;15(8):e0237572. doi: https://doi.org/10.1371/journal.pone.0237572

32. Gonçalves MG, Heineck I. Frequência de prescrições de medicamentos off label e não licenciados para pediatria na atenção primária à saúde em município do sul do Brasil. Rev Paul Pediatr. 2015;34(1):11-7. doi: https://dx.doi.org/10.1016/j.rppede.2015.06.023

33. Moccelin JM, Pissaia LF, Costa AEK, Monteiro S. A educação continuada como ferramenta de qualificação da equipe de enfermagem perante a avaliação da dor em idosos. Cad Pedag. 2018;14(2):161-76. doi: https://dx.doi.org/10.22410/issn.1983-0882.v14i2a2017.1547

34. Mercader-Albaladejo B, Blanco-Soto MV, Roldán-Chicano MT, Rodríguez-Tello J. Influence of continuous subcutaneous insulin infusion in the control of type 1 diabetes in children. Enferm Glob. 2018;17(49):68-95. doi: https://dx.doi.org/10.6018/eglobal.17.1.268361