Subcutaneous Versus Intravenous Rehydration in Hospitalized Older Adults

A Meta-Analysis

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ABSTRACT

Subcutaneous rehydration is an optional infusion route in hospitalized older adults. This meta-analysis sought to compare the effectiveness of subcutaneous versus intravenous (IV) fluid administration to reverse mild-to-moderate dehydration in hospitalized older adults. A literature search was performed. No restrictions were imposed regarding language. Three randomized clinical trials conducted with patients 60 years of age or older treated with subcutaneous or IV rehydration were included, with a total sample size of 197 patients. Controlled quasi-randomized and crossover trials were excluded. The primary end point was reversal of dehydration. Secondary end points were patient satisfaction and frequency of adverse events (eg, cellulitis, edema, phlebitis, erythema, hyponatremia, and pain). Both treatments were effective in rehydrating the patients within 48 hours, with no statistically significant difference between the groups. Subcutaneous fluid administration effectively reversed dehydration while protecting against phlebitis. Since the quality of evidence was considerably low, further multicenter randomized clinical trials of efficient methodological quality should be conducted to consolidate the body of evidence.

Key words: dehydration, hypodermoclysis, intravenous, older adults, rehydration, subcutaneous

Dehydration, defined as a reduction in total body water caused by fluid loss, reduced fluid intake, or a combination of both, is one of the most common complications occurring in older adults during periods of hospitalization.[1,2] The signs and symptoms of dehydration vary but may involve dry mucous membranes, reduced turgidity, reduced perspiration, sunken eyes, tachycardia, hypotension, and, at more advanced stages, altered states of consciousness, oliguria, and kidney failure. In addition, biochemical alterations such as plasma osmolality >295 mOsm/kg, blood urea nitrogen:creatinine ratio >50 mg/dL, and sodium >150 mmol/L are markers of dehydration.[3]

The classification most commonly used defines a scale that ranges from 0 to +3, where 0 indicates no dehydration, +1 indicates mild dehydration (normal blood pressure and normal laboratory values), +2 indicates moderate dehydration (various symptoms are present and biochemical alterations are high), and +3 represents severe dehydration (clinical symptoms are present and serum sodium is >150 mEq/L, osmolality is >300, or urea levels are increased).[4]

The treatment of dehydration essentially consists of replacing fluids, by oral administration whenever possible, because this is considered the route of choice.[5] However, in certain circumstances, such as the presence of cognitive disorders, swallowing difficulties, vomiting, and dyspnea, this route of administration is unviable, and alternative routes are required.[6,7]

In this situation, intravenous (IV) administration can be used; however, rehydration by this route is not free from risks,

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particularly in older adults.[8] Indeed, capillary fragility, changes resulting from the aging process that increase the likelihood of bleeding, and frequent loss of the access site resulting in a greater number of catheter insertions exert a negative effect on morbidity, comfort, and patient satisfaction.[9]

Consequently, with the dissemination of palliative philosophy, hypodermoclysis or subcutaneous fluid administration became more common for the treatment of mild-to-moderate dehydration and was found to represent a safe alternative for the administration of fluids and medication.[10] The subcutaneous route of administration is indicated in situations of gastric intolerance, bowel obstruction, diarrhea, mental confusion, agitation, or delirium and intense dyspnea.[5] It is necessary to change the subcutaneous access site every 7 days when used for drug infusion and every 24 to 48 hours for hydration solutions.[11] Infusions of up to 1.5 to 3 liters per site over a 24-hour period are recommended.[7,11]

The disadvantages that have been reported include the inability to rapidly adjust the volume and speed of the infusion, but they are virtually identical to the adverse events of peripheral IV administration.[5,12] The principal side effects are pain, erythema, phlebitis, fluid overload, edema at the infusion site, and cellulitis, as well as the more severe, albeit rare, systemic reactions, such as infections, hematomas, ecchymosis, hyponatremia, severe edema, and a reaction at the subcutaneous access site.[10]

Despite the practicality and safety of subcutaneous administration, resistance to its use remains, particularly due to the belief that the subcutaneous route is ineffective for rehydration therapy. Therefore, the objective of this meta-analysis was to compare the effectiveness of the subcutaneous route in relation to IV administration in reversing dehydration in hospitalized older adults.

METHODS

This systematic review with meta-analysis follows the recommendations listed in the PRISMA-P statement and was registered at PROSPERO under reference CRD42017077527. The entire review was conducted as described in the protocol, and the data were extracted and stored in the Review Manager software program, version 5.3.5 (The Nordic Cochrane Center, The Cochrane Collaboration, 2014, Copenhagen, Denmark).

Eligibility Criteria

Randomized clinical trials conducted with older adults over 60 years of age submitted to subcutaneous or IV fluid administration for the treatment of mild-to-moderate dehydration were included in the review. Quasi-randomized, controlled, and crossover clinical trials were excluded.

Search Strategy

The study was conducted using the following databases: The Cochrane Central Register of Controlled Trials (Central), MEDLINE via PubMed (1966–2019), Embase via Ovid SP (1980–2019), CINAHL via EBSCOhost (1982–2019), and Lilacs via Bireme (1985–2019). The keywords used were: *hypodermoclysis*, *dehydration*, *aged*, and *clinical trial*. Words in free text and controlled vocabulary/MESH terms were combined, and no limitations were made with respect to the time period. An effort was made to identify all the relevant studies irrespective of the language or publication status.

End Points Evaluated

The primary end point consisted of the reversal of dehydration, defined as a reduction in serum osmolality (normal serum osmolality is between 285 and 295 mOsm/kg), measured at 24 and 48 hours after the initiation of rehydration therapy.[13] The secondary end points evaluated were: patient satisfaction and the frequency of adverse events (eg, cellulitis, edema, phlebitis, erythema, hyponatremia, and pain).

DATA COLLECTION AND THE QUALITY OF STUDIES

Two of the authors independently evaluated the abstracts of all the publications obtained using the aforementioned search strategies to select potentially relevant studies. The articles on clinical trials considered eligible were obtained in full text, thus allowing their relevance to be evaluated based on the predefined inclusion criteria. Both investigators recorded the reasons for excluding clinical trials in the RevMan 5 software program, version 5.3.5 (Cochrane Training, London, United Kingdom). These 2 authors, also working independently, extracted the data using a standardized data collection form produced in RevMan 5; this is software used for preparing and maintaining Cochrane reviews. The Cochrane Collaboration is an independent nonprofit organization that was created to respond to the need to systematically organize research findings and facilitate health decision-making. During the process, the third author was consulted whenever there were differences in opinion.

The quality of the evidence was evaluated using the Grading of Recommendations, Assessment, Development and Evaluation (GRADEpro) system version 3.6 (McMaster University and Evidence Prime Inc, Hamilton, Ontario, Canada) for all the primary and secondary end points. The GRADEpro approach classifies the level of evidence for each end point evaluated as high, moderate, low, or very low, taking 5 evaluation domains into consideration: risk of bias (limitations in study design or execution; see the following section on the risk of evaluation bias), inconsistency of results, indirectness of evidence, imprecision, and publication bias.[14] A review of the evidence for each domain respected the following classification: no (no reduction in levels), severe (reduction of 1 level), and very severe (reduction of 2 levels),[15] with scoring performed by the reviewers in accordance with the interference biases found in these items.

Risk of Bias of Individual Studies

The risk of bias was evaluated using the RevMan 5 program, applying the following criteria for each study included

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in this review: selection bias (generation of randomized sequencing, allocation concealment), performance bias (blinding of participants and investigators), detection bias (blinding of evaluation of results), attrition bias (data from incomplete results), outcome reporting bias (selective reporting), and other types of bias (eg, stopping trial early, control of lost-to-follow-up).

According to the Cochrane tool, grading to assess the risk of bias is divided into: high, low, or unclear. The risk of bias was considered high when 2 or more items evaluated in the studies were not performed.[16] The risk of bias was considered low when the items were accessed adequately, and the risk was considered unclear when the information available in the article was insufficient or low for each item or when it was not adequately reported in the article.[17]

Data Synthesis and Analysis

The statistical analysis was performed using the RevMan 5 program. The end points were dichotomized as the presence or absence of an effect, and results were presented as indexes of relative risk (RR), together with a 95% CI. For the continuous primary end point (reversal of dehydration), the difference in means was used, with the standard deviation serving as the measure of dispersion.

Heterogeneity in each study was evaluated using the I^2 index and the χ^2 test. Heterogeneity was considered substantial if I^2 exceeded 30% or if the P value was $<$ .10 in the χ^2 test for heterogeneity or if there was clearly substantial inconsistency in the direction or in the magnitude of the effects, as judged by visual inspection.

Post Bias Evaluation

The presence of any publication bias and other small study effects was assessed in a qualitative way using a funnel plot. Since less than 10 assays were included in the analysis, it was not possible to test the asymmetry of the funnel graph using variance stabilization regression methods.[18]

Sensitivity Analysis

A sensitivity analysis was performed to explore the effects of fixed-effects or random-effects analyses for results with statistical heterogeneity. Sensitivity analyses were also performed to explore the effect of trial quality on primary outcomes, effectiveness in removing dehydration and secondary outcomes, patient satisfaction, frequency of edema, phlebitis, cellulitis, erythema, hyponatremia, and pain.

RESULTS

Eighty-five articles were identified in the pre-established databases using the search strategies defined for this review. Following initial evaluation in which duplicate articles were excluded, and the remaining articles were submitted to analysis of the title and abstract, 5 clinical trials were considered eligible.

Two clinical trials were excluded because they did not fulfill the eligibility criteria since they involved interventions other than those proposed for this review.[19,20] Therefore, 3 randomized clinical trials, all conducted in Europe, were included.[6,13,21] These studies involved a total of 197 older patients and compared subcutaneous with IV fluid administration for the treatment of dehydration (Figure 1).

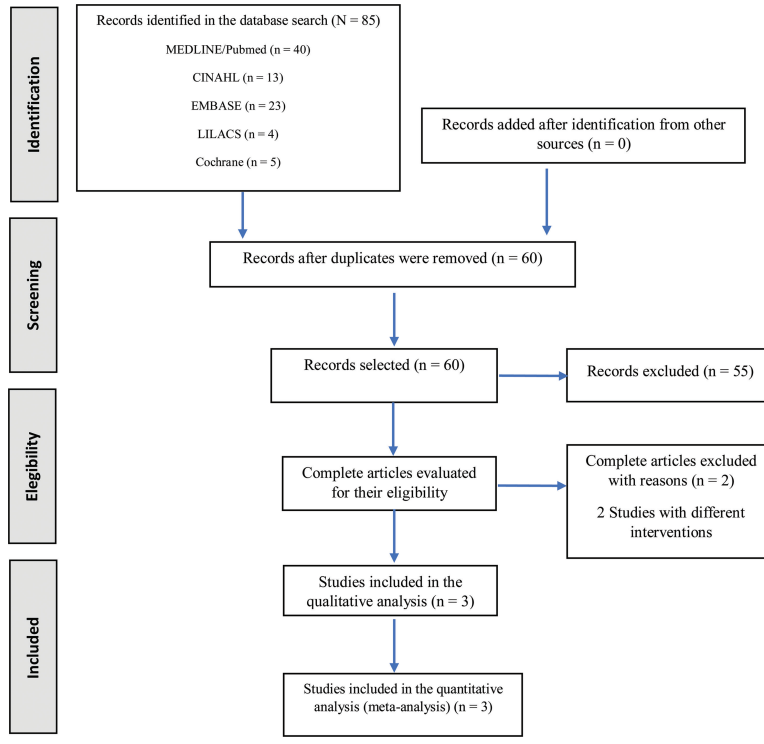

Figure 1 Flowchart of the stages of selecting the articles identified according to PRISMA-P.

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TABLE 1

Characteristics of the Studies Included in the Meta-analysis

Author/year	Participants (n)	Intervention	Placebo	Primary outcome
Challiner[13] UK, 1993	Subcutaneous (17) Intravenous (17)	Subcutaneous: 2 liters of a dextrose-saline isotonic solution (each liter contains 30 mmol of sodium chloride and 40 g of glucose) over 24 h.	Intravenous: the same solution used in the intervention group.	Efficacy of the subcutaneous route of hydration for rehydration in older adults following an acute stroke. Hydration defined according to a reduction in blood osmolality.
Noriega[6] Spain, 2014	Subcutaneous (34) Intravenous (33)	Subcutaneous: administration of a maximum of 1.5 L/d of the following solutions: 0.9% saline solution, 5% glucose solution, and mixed solution (0.45% saline solution + 5% glucose solution) over 24 h.	Intravenous: the same solution used in the subcutaneous group.	Noninferiority of the subcutaneous route compared to the intravenous route in rehydration of hospitalized older adults.
Slesak [21] Germany, 2003	Subcutaneous (48) Intravenous (48)	Subcutaneous: bolus infusion of 500 mL every 2-6 hours of a glucose-saline solution containing 5% glucose and semi-isotonic electrolytes.	Intravenous: the same solution used in the subcutaneous group.	Acceptance and viability of subcutaneous infusion compared to the intravenous route in older patients, defined according to changes in the relevant clinical and laboratory parameters.

In all the studies, subcutaneous fluid administration (intervention group) was used in older adults over 60 years of age with clinically confirmed dehydration and oral intolerance. The studies were all conducted in geriatric hospitals, and subcutaneous fluid therapy was compared to IV fluid therapy (control group). In 2 studies,[6,13] the intervention was evaluated over a 24- to 48-hour period; however, in the other study,[21] the intervention was evaluated over a period of 2 to 6 hours in accordance with clinical need. The volume and types of solutions differed across the studies. The principal characteristics of the intervention protocols are described in Table 1.

In 2 of the studies[6,21] the process used to generate the randomization sequence was unclear. None of the studies described the blinding of the participants (it is not possible to blind the participants), investigators, or the evaluators of the results; therefore, this was classified as a risk of performance and/or detection bias. Further information on the analysis of the risk of bias in the studies included in this review is described in Figure 2.

Primary End Points

The primary end point, reversal of dehydration, was evaluated in 2 studies[6,13] according to osmolality (101 patients), and the difference in the mean was obtained from a random effect model.

Both treatments effectively reduced serum osmolality after 48 hours of rehydration treatment. The intervention group in which subcutaneous infusion was used resulted in a mean reduction of 9.48 in osmolality ($P = .003$; 95% CI, 3.16–15.80), while in the control group in which IV infusion was used there was a reduction of 11.26 in osmolality at

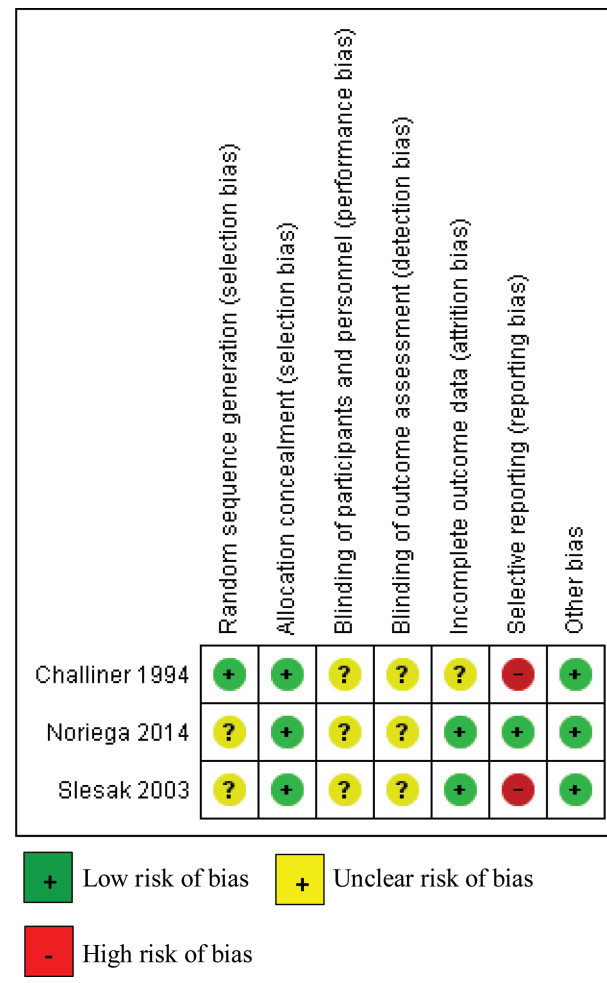

Figure 2 Summary of the risk of bias.

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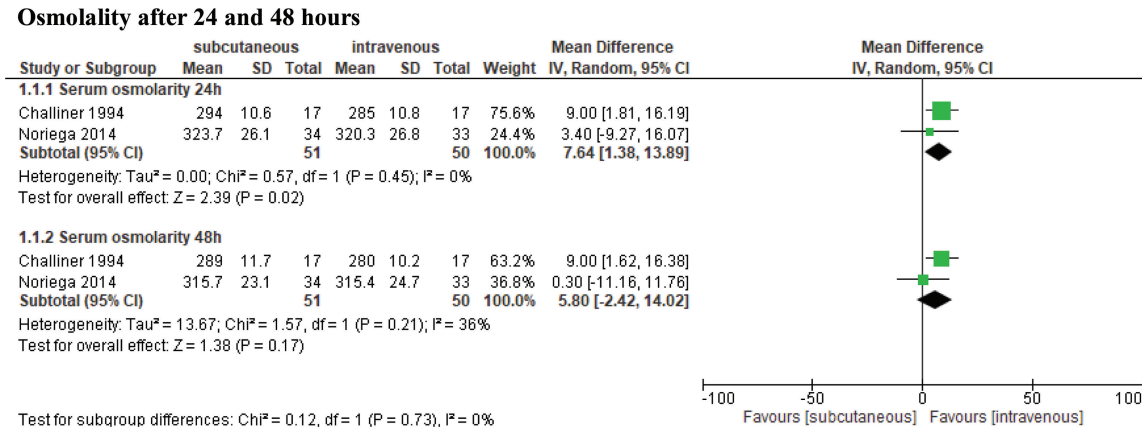

Figure 3 Forest plot for the primary end point analyzed: subcutaneous versus intravenous fluid administration. $\chi^2 = \chi^2$ test; CI = confidence interval; h = hours; I^2 = measure of inconsistency (heterogeneity); IV = intravenous; *P* = value indicating level of statistical significance.

the end of treatment (*P* = .0001; 95% CI, 5.50–17.02). Therefore, based on a very low quality of evidence, after 48 hours there was no statistically significant difference between the groups (mean difference = 5.8; *P* = 0.17; 95% CI, 2.42–14.02; I^2 = 36%).

In contrast, following subgroup analysis, in the first 24 hours of rehydration therapy, a mean difference of 7.64 was found in osmolality in favor of the control group, with a statistically significant difference between the groups (mean difference = 7.64; *P* = .02; 95% CI, 1.38–13.89) (Figure 3). Table 2 shows a detailed evaluation of the quality of the evidence assessed in accordance with the GRADEpro system.

Secondary End Points

The occurrence of phlebitis was investigated in 2 clinical trials (163 patients)[6,21] with significantly fewer events occurring in the subcutaneous infusion group (RR = 0.10; *P* = 0.03; 95% CI, 0.01–0.76). However, the level of evidence for this end point was very low (Figure 4).

The presence of cellulitis was evaluated in 2 of the studies included in the review (163 patients)[6,21] and the presence of edema in 3 (197 patients).[6,13,21] No evidence of any difference between the groups was found in relation to either of these 2 end points (cellulitis: RR = 1.51; *P* = .69; 95% CI, 0.21–10.94 and edema: RR = 1.65; *P* = .09; 95% CI, 0.93–2.73); however, the level of evidence was very low (Figure 4).

A low level of evidence was also found for the presence of erythema (130 patients)[13,21] and hyponatremia (111 patients),[13,21] evaluated in 2 of the studies, and no statistically significant difference was found between the groups (erythema: RR = 1.09; *P* = .82; 95% CI, 0.53–2.23; I^2 = 19% and hyponatremia: RR = 0.49; *P* = 0.28; 95% CI, 0.13–1.79) (Figure 4).

Only 1 study evaluated pain (96 patients),[21] with no evidence of any statistically significant difference between the groups (RR = 0.75; *P* = .57; 95% CI, 0.28–2.0). Therefore, since this was 1 single study with a high risk of bias, the level of evidence for this end point was classified as very low.

Finally, patient satisfaction, also analyzed from 1 single study (96 patients),[21] was investigated in a very small number of participants, and the results were presented as medians per quartile. An attempt was made to convert medians to means[22]; however, the measure of estimated effect was not applicable.

DISCUSSION

The results of this review showed that after 48 hours of rehydration therapy, no statistically significant difference was found between subcutaneous and IV infusions as evaluated according to serum osmolality. Regarding the development of phlebitis, a statistically significant difference was found between the groups, with fewer cases in the subcutaneous administration group. In relation to the other adverse events, there was no evidence of any statistically significant difference between the groups, although the level of evidence was very low. Regarding patient satisfaction, it was not possible to measure the effect of this intervention.

One of the greatest challenges in clinical practice is evaluating blood volume in an individual and assessing the effectiveness of fluid administration. An arsenal of clinical parameters and laboratory tests is often necessary to enable an early and accurate diagnosis to be reached and the treatment implemented to be adequately evaluated. In the older adult population, diagnosis and treatment are even more challenging due to the peculiarities of age.[9]

In view of the absence of any reliable clinical parameters that could confirm the reversal of dehydration in the older adult population, most studies use biochemical parameters that indirectly reflect fluid replacement in the bloodstream. This explains why the majority of studies included here used osmolality as the laboratory parameter through which to evaluate the primary end point reversal of dehydration.

After 48 hours of therapy for rehydration, results showed there is no evidence of any difference between the subcutaneous and IV administration routes. This suggests efficacy of both routes in the treatment of mild-to-moderate

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TABLE 2

Summary of Findings

Patient or population: Patients with dehydration hospitalized in a geriatric unit
Settings: European geriatric hospitals
Intervention: Subcutaneous
Comparison: Intravenous

Outcomes	Illustrative comparative risks[a] (95% CI)		Relative effect (95% CI)	No. of participants (studies)	Quality of the evidence (GRADE)
	Assumed risk	Corresponding risk			
	Intravenous	Subcutaneous			
Serum osmolality - Serum osmolality after 24 hours Biochemical parameter measured according to serum osmolality 24 hours after initiation of hydration Mean follow-up: 1 day	Mean serum osmolality - Serum osmolality after 24 hours in the control groups was **302 mOsm/kg**	Mean serum osmolaity - Serum osmolality after 24 hours in the intervention groups was **7.91 mOsm/kg higher** (2.31–13.51 mOsm/kg higher)		101 (2 studies)	⊕⊖⊖⊖ **very low**[b,c,d]
Serum osmolality - Serum osmolality after 48 hours Biochemical parameter measured according to serum osmolality 48 hours after initiation of hydration Mean follow-up: 2 days	Mean serum osmolality - Serum osmolality after 48 hours in the control groups was **297 mOsm/kg**	Mean serum osmolality - Serum osmolality after 48 hours in the intervention groups was **5.8 higher** (2.42 lower to 14.02 higher)		101 (2 studies)	⊕⊖⊖⊖ **very low**[b,c,e]
Cellulitis The incidence of cellulitis as defined by the trial authors	**Study population**		**RR 1.51** (0.21–10.94)	163 (2 studies)	⊕⊖⊖⊖ **very low**[b,f]
	13 per 1000	**20 per 1000** (3–142)			
	Moderate				
	11 per 1000	**17 per 1000** (2–120)			
Edema The incidence of minor or major edema as defined by the trial authors	**Study population**		**RR 1.65** (0.93–2.93)	197 (3 studies)	⊕⊖⊖⊖ **very low**[f,g,h]
	96 per 1000	**158 per 1000** (89–281)			
	Moderate				
	61 per 1000	**101 per 1000** (57–179)			
Phlebitis The incidence of phlebitis as defined by the trial authors	**Study population**		**RR 0.1** (0.01–0.76)	163 (2 studies)	⊕⊖⊖⊖ **very low**[b,i]
	104 per 1000	**10 per 1000** (1–79)			
	Moderate				
	99 per 1000	**10 per 1000** (1–75)			
Erythema The incidence of erythema as defined by the trial authors	**Study population**		**RR 1.09** (0.53–2.23)	130 (2 studies)	⊕⊖⊖⊖ **very low**[b,f]
	169 per 1000	**184 per 1000** (90–377)			
	Moderate				
	115 per 1000	**125 per 1000** (61–256)			

(continues)

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TABLE 2

Summary of Findings (*Continued*)

Hyponatremia The incidence of hyponatremia as described by the trial author	**Study population**		**RR 0.49** (0.13–1.79)	111 (2 studies)	⊕⊖⊖⊖ **very low**[b,f]
	111 per 1000	**54 per 1000** (14–199)			
	Moderate				
	145 per 1000	**71 per 1000** (19–260)			

GRADE Working Group grades of evidence:
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

Abbreviations: GRADE, Grading of Recommendations, Assessment, Development and Evaluation; RR, relative risk.
[a]The basis for the assumed risk (eg, the median control group risk across studies) is provided in the footnotes. The corresponding risk (and its 95% CI) is based on the assumed risk in the comparison group and the relative effect of the intervention (and its 95% CI).
[b]The outcome was assessed by 2 randomized studies. The risk of bias was high in both, mainly because of unclear data and problems with reporting bias. Final decision: Downgraded 2 levels (very serious) due to risk of bias.
[c]All randomized trials included provide indirect evidence bearing on the potential effectiveness of hydration therapies studied based on serum osmolality. The effectiveness of the intervention and the accuracy of the imaging methods were not assessed. Final decision: Downgraded 1 level.
[d]Although the confidence interval did not contain zero, it included the calculated minimal clinically important difference. The width of the confidence interval also reflects a small sample size. Final decision: Downgraded 1 level (serious) due to imprecision.
[e]The confidence interval contained zero and included the calculated minimal clinically important difference. The width of the confidence interval also reflects a small sample size. Final decision: Downgraded 2 levels (very serious) due to imprecision.
[f]The width of the confidence interval varied widely, and the optimal information size was not reached (small sample size). The confidence interval contained zero. Final decision: Downgraded 2 levels (very serious) due to imprecision.
[g]The outcome was assessed by all the trials included. The risk of bias was high in all, mainly due to unclear data and problems with reporting bias. Final decision: Downgraded 2 levels (very serious) due to risk of bias.
[h]Different volumes of fluids were used. Furthermore, 1 study graded the intensity of the edema, which may have contributed to important discrepancies in the incidences of this outcome based on the studies included. Final decision: Downgraded 1 level due to inconsistency.
[i]Although the confidence interval did not contain zero, the optimal information size was not reached. Downgraded 1 level (serious) due to imprecision.

dehydration in elderly patients. Despite the low quality of the evidence, this result is promising if the subcutaneous route of administration is confirmed as a viable option.

In the subgroup analysis, a statistically significant difference was found between the 2 groups, with a more expressive reduction in osmolality in the IV control group in the first 24 hours of rehydration therapy. This finding could be explained by the process of transportation of the fluid injected subcutaneously to the bloodstream, which depends on the blood and lymph capillaries located in the hypodermis, unlike the direct process involved in IV administration.[5] Therefore, subcutaneous administration requires more time for the fluid to reach the vessel and reverse the dehydration process.

As expected, the rate of phlebitis was 90% lower in older patients who received subcutaneous fluid administration, and this difference was statistically significant. Phlebitis is typically a complication associated with IV infusions and is characterized by acute inflammation and may be associated with subsequent thrombus formation inside of the peripheral vessels affecting 3% to 11% of the general population. Phlebitis is one of the most common complications associated with the use of venous catheters and results in direct consequences for the patient with difficult venous access, particularly older adults, increasing the number of catheter insertions and the amount of pain and discomfort.[23] Therefore, an access route that protects the patient from this adverse event represents an important option.

Studies have shown the incidence of phlebitis development in patients using IV catheters. The cohort study conducted in Porto Alegre, with 171 patients included, found an incidence rate of phlebitis of 2.63%, both during use and after catheter removal.[24] In another cross-sectional study with 63 participants, an incidence of phlebitis of 25.4% was found.[25] Inhomogeneous findings can be justified by presenting different samples and methods between studies. No relevant studies were found that address the incidence of phlebitis in subcutaneous therapy, as evidenced by the studies included in the meta-analysis.

No statistically significant difference was found between the groups in relation to any of the other adverse events evaluated: cellulitis, erythema, edema, and hyponatremia. The first 3, although classified in some studies as minor adverse events, may generate discomfort, cause pain, and limit mobility, with a negative effect on the hospitalized patient.[10]

Hyponatremia, defined as a hydroelectrolytic disorder with serum sodium levels below normal ($Na^+ < 135$ mEq/L), is a more severe complication, requiring immediate fluid

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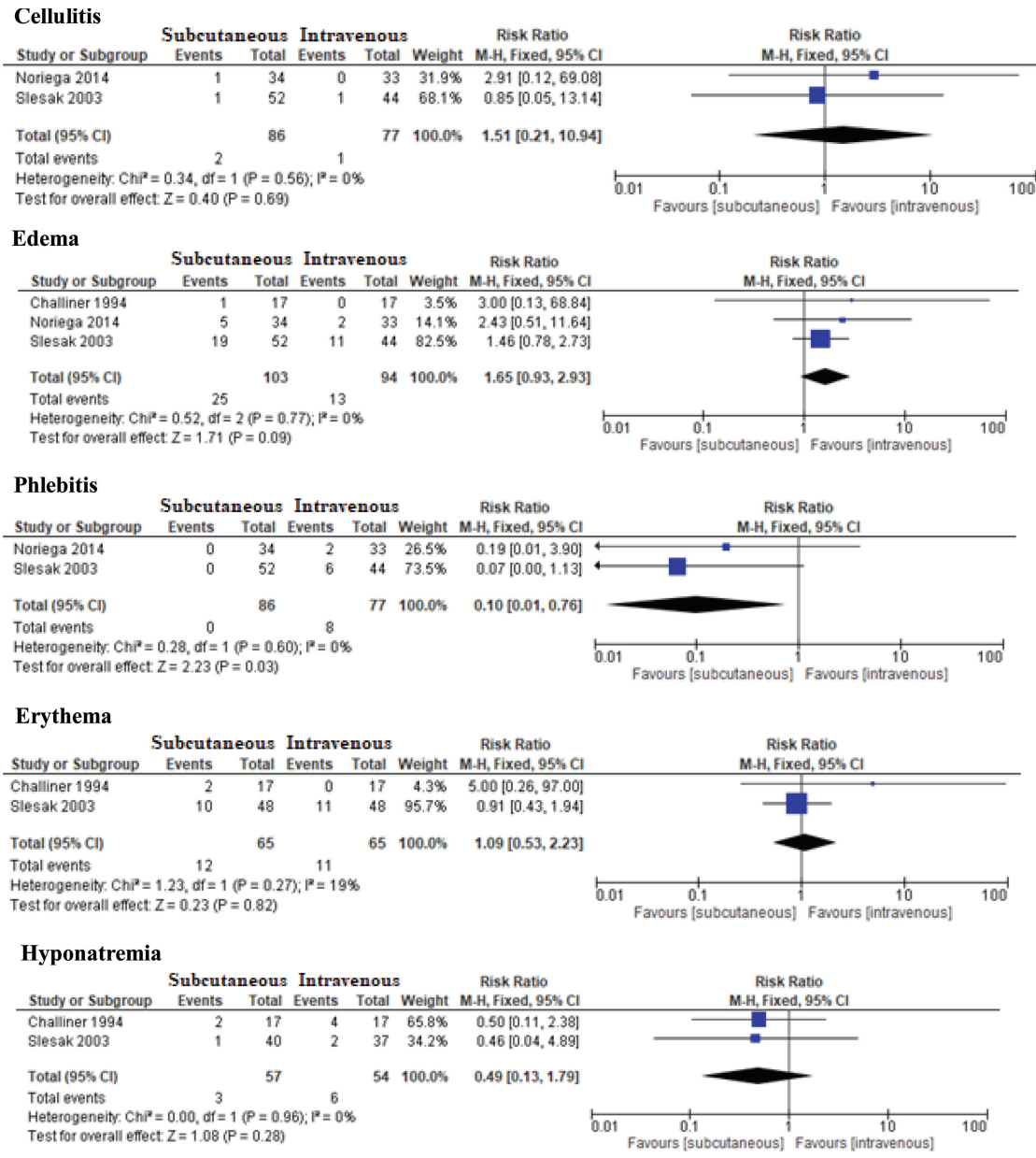

Figure 4 Forest plot for the secondary end points analyzed: subcutaneous versus intravenous fluid administration.

administration and fast infusion. The consequences of hyponatremia include nausea, mental confusion, headache, and, when severe, vomiting, somnolence, cardiorespiratory difficulty, convulsions, and coma.[26] The subcutaneous route of administration did not significantly increase any of these complications when compared to IV administration.

Pain and patient satisfaction are considered highly relevant end points because they reflect the quality of health care[27] and are often used to guide clinical practice, particularly in the context of institutionalized older patients. Nevertheless, these parameters were not adequately evaluated in the studies.

The subcutaneous access route is widely used for fluid administration and the infusion of various drugs, available in most hospitals, and is considered a simple means of access by the health care team and extremely comfortable for the patients and their families.[5,28] For these reasons, it would appear appropriate to evaluate the subcutaneous route as an alternative to the more invasive routes.

LIMITATIONS

Limitations of this meta-analysis included the low quality of the studies conducted to evaluate the subject in question, with a high risk of bias and small sample sizes. In addition, the volume and types of solutions used for rehydration were not standardized, hampering evaluation of the effectiveness of the intervention and weighing negatively on the inconsistency of the results.

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CONCLUSION

Despite the limitations described in this review, the subcutaneous route was observed to be effective in the remission of dehydration in hospitalized patients over the age of 60 years who presented mild or moderate dehydration, mainly in cases in which the oral route could not be used and the IV route became difficult. The intervention was shown to protect against phlebitis, whereas no statistically significant difference was found between the groups for any of the other adverse events evaluated (edema, erythema, cellulitis, and hyponatremia), all with a very low level of evidence, affecting the grade of recommendation. Although phlebitis is an adverse effect that usually occurs in IV infusion, it is important to report the evidence found in this study that, after analyzing the data, the intervention demonstrated to protect against phlebitis, an effect found in patients with IV infusions.

Only 1 of the studies reported on pain management with the level of evidence significantly low. Data were insufficient to enable an evaluation of patient satisfaction. Gaps also remain with respect to the effectiveness of the subcutaneous route in reducing the need to change subcutaneous access sites, which would appear to favor cost-effectiveness. This would represent a strategic option and constitute yet another advantage of using this route of administration needing more studies. Further studies should also be conducted to consolidate the body of evidence and clarify questions that arose and others that were not evaluated. Multicenter randomized clinical trials using high-quality methodology are required to meet these goals.

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