Hemodynamic oxygenation effects during the bathing of hospitalized adult patients critically ill: systematic review*

Repercussões oxi-hemodinâmicas do banho no paciente em estado crítico adulto hospitalizado: revisão sistemática

Repercusiones de la oxigenación hemodinámicas en el baño en el paciente en estado crítico adulto hospitalizado: revisión sistemática

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ABSTRACT

Objectives: To identify scientific evidence on the impact of hemodynamic oxygenation of the bathing in the adult patient hospitalized in critical condition; to verify the possibility of establishing criteria for the indication of the bathing in that patient, based on hemodynamic effects of oxygenation in different clinical situations. **Methods**: Systematic review of primary and secondary literature, without restriction of time or language. PIO strategy used: P (problem) = "Intensive Care Units" and variations, I (intervention) = bathing and variations; O (result) = "Hemodynamic Phenomena" / "Oxygen Consumption" and variations. Sources: CINAHL databases, Dedalus, EMBASE, COCHRANE, LILACS, PubMed / MEDLINE; libraries of Nursing Schools, Fluminense Federal University and Federal University of Rio de Janeiro; cross references, and, articles from PubMed and ISI. **Results**: Of 44,597 references six quasi-experiments remained. During the bathing, mixed venous oxygen saturation declined significantly from baseline, being restored 30 minutes later. **Conclusion**: The conditions that increase risk are: bathing less than four hours after cardiac surgery, prolonged lateral decubitus positioning, and, bathing time exceeding 20 minutes: maintenance of water temperature at 40 ° C, for protection.

Keywords: Baths; Nursing care; Hemodynamic; Evidence-based medicine; Oxymetry, Intensive care units

RESUMO

Objetivos: identificar evidências científicas sobre as repercussões oxi-hemodinâmicas do banho no paciente adulto internado em estado crítico; verificar a possibilidade de estabelecimento de critérios para indicação do banho nesse paciente, com base em repercussões oxi-hemodinâmicas nas diferentes situações clínicas. **Métodos:** Revisão sistemática da literatura primária e secundária, sem recorte temporal ou idiomático. Utilizada estratégia PIO: P (problema) = "Intensive Care Units" e variações; I (intervenção) = banho e variações; O (desfecho) = "Hemodynamic Phenomena" / "Oxygen Consumption" e variações. Fontes: bases de dados CINAHL, DEDALUS; EMBASE, COCHRANE, LILACS, PubMed/MEDLINE; bibliotecas das Escolas de Enfermagem da Universidade Federal Fluminense e Universidade Federal do Rio de Janeiro; referências cruzadas e; artigos relacionados do Pubmed e ISI. **Resultados**: De 44597 referências restaram seis quase-experimentos. Durante o banho, a saturação venosa mista de oxigênio declinou consideravelmente do *baseline*, restabelecendo-se 30 minutos após. **Conclusão:** Condições que aumentam o risco: banho em menos de quatro horas após a cirurgia cardíaca, posicionamento prolongado em decúbito lateral e tempo de banho superior a 20 minutos: manutenção da temperatura da água em 40°C, para proteção.

Descritores: Banhos; Cuidados de enfermagem; Hemodinâmica; Medicina baseada em evidências; Oximetria; Unidades de terapia intensiva

RESUMEN

Objetivos: identificar evidencias científicas sobre las repercusiones de la oxigenación hemodinámica del baño en el paciente adulto internado en estado crítico; verificar la posibilidad de establecimiento de criterios para indicación del baño en ese paciente, con base en repercusiones de oxigenación hemodinámica en las diferentes situaciones clínicas. **Métodos:** Revisión sistemática de la literatura primaria y secundaria, sin recorte temporal o idiomático. Se utilizó la estrategia PIO: P (problema) = "Intensive Care Units" y variaciones; I (intervención) = baño y variaciones; O (resultado) = "Hemodynamic Phenomena" / "Oxygen Consumption" y variaciones. Fuentes: bases de datos CINAHL, DEDALUS; EMBASE, COCHRANE, LILACS, PubMed/MEDLINE; bibliotecas de las Escuelas de Enfermería de la Universidad Federal Fluminense y Universidad Federal de Rio de Janeiro; referencias cruzadas y; artículos relacionados del Pubmed y ISI. **Resultados**: De 44597 referencias restaron seis casi-experimentos. Durante el baño, la saturación venosa mixta de oxígeno declinó considerablemente del *baseline*, restableciéndose 30 minutos después. **Conclusión:** Condiciones que aumentan el riesgo: baño menos de cuatro horas después de la cirugía cardíaca, posicionamiento prolongado decúbito lateral y tiempo de baño superior a 20 minutos: manutención de la temperatura del agua en 40°C, para protección.

Descriptores: Baño; Cuidados de enfermería; Hemodinámica; Medicina basada en evidencia; Oximetria, Unidades de cuidados intensivos

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INTRODUCTION

The National Health Surveillance Agency (ANVISA) defines a critical patient as a severe patients, with one or more of the main physiological systems at risk, including loss of self-regulation, demanding artificial function replacement and continuous care[1]. Although the main physiological systems are at risk, critical patients maintain their hygiene and comfort needs, which demand nursing team actions. At hospitals, critical patients frequently receive specialized care at emergency, intensive care or surgical center units.

Intensive Care Units (ICU) need qualified and highly specialized professionals, as diagnosis, monitoring, support and therapeutic activities are developed at these sectors. Given the patients' characteristics, these are extremely complex interventions, either due to the severity or the instability that makes them more vulnerable. Hence, they depend on strict follow-up by the involved care team.

Even techniques applied without further difficulty in stable patients, including bathing, become complex in critical patients. These nursing actions need adequate planning and a trained team with know-how, with a view to offering clients damage-free care, bio-functional improvement, satisfaction and comfort.

Among different conditions patients are submitted to at the ICU, bathing can entail different effects: on thermal regulation, oxy-hemodynamic balance, microbiology[2-4], hospital costs[5], client satisfaction[6-8].

These factors, in combination with the lack of and disagreement in scientific publications about the oxy-hemodynamic effects of bathing on adult critical patients, as well as the inexistence of a consensual explanatory model to perform the technique under analysis, justify a closer look at the theme. On the other hand, an intervention like bathing can be studied from different research foci. Hence, bathing can be analyzed as a hyperthermia treatment, thus receiving a treatment focus, or be investigated as a daily practice inherent in nursing activities, and as a basic human need that, like any other activity, is not free from causing client damage. To delimit this research, publications were considered that involve bathing among adult hospitalized patients in critical conditions and in the *etiology/damage*[7] context only, with a view to reaching the following objectives: to identify scientific evidence about the oxy-hemodynamic repercussions of bathing on adult hospitalized patients in critical conditions; to verify whether criteria can be established to indicate bathing in these patients, based on oxy-hemodynamic effects in different clinical situations.

METHODS

Systematic literature Review (SR) is the most used resource in Evidence-Based Practice. This is a modern method for the simultaneous assessment of data from primary studies, frequently used to obtain scientific evidence of health interventions[8]. According to these concepts, the limitations of this method can be forecasted, as these studies represent only a part of existing designs.

SR differs from classical literature reviews, called narrative or integrative reviews, which are descriptive-discursive and offer broad presentations and discussions about themes of scientific interest. Narrative reviews permit the acquisition and updating of knowledge about a specific theme, within a short time period. Disadvantages, however, include the fact that they cannot be reproduced, are sometimes incomplete and in some cases inconclusive[9].

When confronted with narrative reviews, the following advantages of SR are considered[9]: replicable method; prevention of research duplication; rapid updating; prevents controversies in literature, as what matters is not the number of favorable studies, but the sum of all properly studied cases; anticipation of large clinical trial results by decades, given technical and/or financial difficulties; early detection of inadequate treatments; increased data precision; identifies areas that lack primary studies; saves clinical research and medical care resources; supports health policy decisions. Disadvantages[9] include: time consuming; great intellectual work; does not manage to improve the quality of primary studies, as secondary data are used; difficulty to carry out the review without the help of a second professional; need for good sense in terms of evidence and opinions.

The review is called qualitative SR or simply SR when the obtained information cannot be subject to statistical analysis. On the other hand, when statistical analysis and summary measure calculations are possible, it is called quantitative SR or Meta-analysis (MA)[10].

Hence, for each clinical question type: etiology, diagnosis, risk, prognosis, treatment/prevention, criteria exist for a study to be considered valid and scientifically appropriate. Thus, the search for evidence is guided by its relevance and quality, with a view to a highly sensitive and specific research[9].

The classification of evidence is conditioned by its source, the design or original studies, the intensity of the observed effects and the possibility of random errors[11]. The degree of recommendation is ranked and derives from the clinical outcomes found in the research. These guide the indication of conducts professionals should adopt, based on the best possible scientific evidence[12].

When there is no research to sustain the evidence or no consensus about its efficacy, texts or letters are accepted with specialists' opinions in the area of the clinical questions, as well as experience reports[13-17]; this action is not considered recommendable though, and supportive studies are suggested[18].

Different evidence classification proposals exist[15-17, 19-20]. In this study, the model by Oxford9 developed in 2001 was used. For etiology/damage research in this scale, the degree of recommendations ranges from A do D, and levels from 1A (systematic review with homogeneous randomized controlled clinical trials) to 5 (consensuses, biological material and animal model). Despite countless classification forms of research recommendations, however, it is practically a consensus that the best forms are systematic reviews with meta-analysis of randomized clinical trials (RCT), followed by RCT themselves and then other types.

The criteria to include studies into the SR were: designs

(experimental, quasi-experimental, observational or review) that addressed bathing for adult hospitalized patients in critical conditions as the central theme and that analyzed its effects on the oxy-hemodynamic outcomes; patient types (adults and elderly in critical conditions according to ANVISA[1], hospitalized in intensive care units and submitted to bathing by the nursing team); environment (adult, clinical or surgical ICU, coronary units, emergency and burns treatment units, as well as bathing in any intra-hospital environment that receives critical patients, characterized according to ANVISA's definition[1]; types of bathing (routinely used in the Western world, in this case bed baths); outcomes (oxygen consumption, cardiac output, arteriovenous and alveolar-capillary oxygen difference, heart frequency, cardiac index, oxygen supply, mean blood pressure, blood pressure, pulmonary arterial pressure, pulmonary capillary pressure, central venous pressure, pulmonary vascular resistance, systematic vascular resistance, breathing, oxygen saturation in mixed venous blood, transcutaneous oxygen saturation in arterial blood, temperature, venous oxygen tension). Exclusion criteria were: reflection articles, reviews without a clear and replicable method; non-human populations, patients in non-critical condition, outpatients, patient in home care or not hospitalized; bathing in the context of extra-renal depuration methods or occasional operating room baths, immersion baths or sauna.

To obtain scientific evidences based on the publications, infrastructure was needed with the following components: equipment (hardware and software), access to databases and library and translation services.

The involved equipment included a portable computer with basic software (word processor and electronic worksheet), besides specific bibliographic reference management software (Endnote®).

Access to electronic databases was obtained through an institutional password of the Coordination for the Improvement of Higher Education Personnel[I] (CAPES) PortalI, remotely accessed through IP Address identification of the authorized provider of *Universidade Federal Fluminense*. Another access form to electronic databases was through remote access to the University of São Paulo's Virtual Private Network.

Library services involved the importation of previously selected papers through the Document Access Cooperation Service.

In compliance with guidelines by the Cochrane Collaboration, a pioneer and reference in systematic reviews in Brazil, a second researcher[II] participated, with expertise in systemic reviews, for the sake of analysis of relevant studies preselected by the main researcher.

The literature search involved six levels: a) review and registered clinical trial databases: Cochrane Database of Systematic Reviews - CDSR[III]; Database of Abstracts of Reviews of Effectiveness - DARE and Health Technology Assessment database – HTA at the Centre for Reviews and Dissemination[IV] of York University and the National Health Research Institute in the United Kingdom; database of registered clinical trials[V], maintained by the US National Health Institute and its version maintained by private initiative[VI]; b) electronic scientific literature databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), DEDALUS (USP), EMBASE, Latin American and Caribbean Health Science Literature (LILACS), MEDLINE (main component of PUBMED); c) cross references of preselected publications, in order to identify material of interest accessed through the electronic databases; d) related articles in the PUBMED environment and Web of Science / ISI; e) traditional libraries at Anna Nery School of Nursing at the Federal University of Rio de Janeiro (EEAN-UFRJ), at Aurora de Afonso Costa School of Nursing at the *Universidade Federal Fluminense* (EEAAC-UFF) and at the University of São Paulo School of Nursing (EEUSP), oriented by the DEDALUS search engine, so that the research was guided by the search arguments characteristic of each database and later described and; f) e-mail contact with authors, institutions and editors, requesting additional information about the research.

The search indexation considered the thesauri (controlled vocabulary), truncation and extensions in each environment, combined by boolean search operators (and, or, not).

Given the frequent updating of the databases, the researchers attempted to cover all databases in a short period, between August 25th and September 18th 2008.

As PUBMED, CINAHL and EMBASE are more solid bases, associated with the low specificity level of the theme, an adapted version of the PICO(21) model was adopted, whose original proposal means: P = Patient, population; I = Intervention; C = Control; O = Outcome.

As this review included studies that did not necessarily include control groups, the adaptation only corresponded to the exclusion of the letter C, that is:

PUBMED/EMBASE/CINAHL = (I C P) + (I O)

As LILACS, DEDALUS and COCHRANE are more restricted databases, the search focused on the intervention, that is, the bath.

CINAHL, EMBASE, LILACS, MEDLINE/PUBMED, *RELATED ARTICLES*/PUBMED and ISI/WOS permit the exportation of references, including abstracts when available, to reference management programs. Hence, Endnote version 9.0 (BLD 1425*)* software was used, property of the Thomson Corporation, which among other characteristics permits new filtered searches in the created database; importation and exportation of references with different extensions according to the electronic database editor; removal of redundant (duplicated) references; besides interaction with word processing and electronic worksheet software.

As COCHRANE and DEDALUS are non-exportable databases, relevant studies were preselected manually. The same

[I] www.periodicos.capes.gov.br

[II] Silvia Helena Frota Mendonça, nurse, author of the Master's thesis entitled "Impact of needleless connectors in closed infusion systems on the occurrence of bloodstream infection related to the use of central venous catheters: evidence from a systematic review", defended at EEUSP in April 2008.

[III] http://www.cochrane.org/reviews/

[IV] http://www.york.ac.uk/inst/crd/

[V] http://www.clinicaltrials.gov/

[VI] http://www.controllled.trials.com/

was done in the traditional libraries at EEAN-UFRJ and EEAAC-UFF.

Data were collected in two different phases, based on an adaptation of the Cochrane Collaboration model, guided by a critical assessment model of publications BY LAYERS, adapted from the diagram recommended by Fletcher and Fletcher[22]. Gross data, obtained from eligible publications, were subject to successive refinement, as high sensitivity tends to be associated with low specificity[23].

Thus, the systematic review process was divided in two distinct, consecutive and dependent moments: from eligible to relevant studies (preselected publications), conducted by researcher 1 and; from preselected (relevant) to selected studies (included studies), developed independently by researchers 1 and 2, as recommended by the Cochrane model, followed by consensus meeting to decide on the publications' inclusion or exclusion.

After exclusion of eligible publications from exportable electronic databases, inclusions were added related to: cross references, related articles PUBMED and ISI, non-exportable databases COCHRANE and DEDALUS, separately assessed exportable LILACS database and manual search in conventional libraries.

The data collection instrument, developed by the authors[VII] is an adaptation and further elaboration of a tool originally conceived[II] in a systematic review about vascular connectors. Besides information directly extracted from the publications, it covers the researcher-extractor's opinion and two evidence classifications: Oxford[10] and Downs & Black[24].

RESULTS

The 44597 initial results from the electronic databases were exported to a reference management program, submitted to successive filtering, resulting in 23 publications that, in combination with two monographs from conventional libraries, totaled 25 references. After reading of the full versions and consensus meetings, 19 were discarded, totaling a sample of six publications, called: E01[25], E02[26], E06[27], E10[28], E13[29] and E15[30] Hence, 19 preselected publications were rejected: five referred to immersion baths; four to a healthy population and immersion baths; three to populations in non-critical conditions; two to immersion baths and populations in non-critical conditions; two contained insufficient information; one referred to a non-hospitalized population; one was excluded due to the publication design (letter to the editor) and one to an intervention that was not bathing but defecation.

Four out of six selected studies refer to publications in Latin languages, particularly Brazilian production, three of which are monographs. Thus, half of the selected studies was not found in the form of journal articles, nor electronically. The studies are concentrated in nursing, but the majority is not included in Qualis Capes, either because it are monographs or because this index does not include many journals outside the axis of Anglo-Saxon American and European countries. The classified journals receive high scores though. Finally, only one of the six studies included in the SR came from secondary sources. The six studies used the same quasi-experimental design, but E01 and E15 present more than one intervention. E01, E06 and E13 refer to patients after coronary artery bypass graft surgery. E06 and E13 did not mention adopted exclusion criteria. Although the scope of all studies considered the investigation of oxy-hemodynamic data, these did not coincide among the studies.

Despite the generalized use of convenience samples, only two (E01 and E15) expressed this characteristic. Only studies E01 and E02 reported and described sample unit losses, which stayed within the 20% margin.

Among the six studies included, only one (E13) did not describe the bathing technique. Among the five that described it, only E1 and E 15 reported some strategy to control heat loss while bathing. E02 was the research with the longest follow-up, totaling three days of data collection. One third of the selected studies really did not present the duration of bed bathing. Based on the records of studies that published the bathing time variable (n= 4), 20 minutes and 14 seconds was calculated as the global average total bathing time. E15 presented the average bathing time that most closely approximated the global average time, i.e. 19 minutes and 26 seconds.

There was agreement about the initial temperature of bed bathing water for critical patients, ranging from 37°C (E10) to 40°C (E15).

The most complete studies in decreasing order of control for confounding variables were E01 (16), E03 and E06 (12), E15 (11), E06 (10), E02 (8). When ignoring variables that were mentioned but not presented (MBNP) though, the order changed to: E15 (11), E01 e E06 (10), E10 (9), E02 (8) and E13 (6). On the other hand, E01 and E15 went beyond the classical before-and-after study, as they previewed the creation of subgroups, in which they varied time (E01) and water temperature (E15).

Mixed venous oxygen saturation (SvO_2) was the most studied outcome in this SR, totaling 1/8 (12.5%) of all actually presented outcomes. Next came cardiac index (9.38%) and heart frequency (HF), with 6.25%, partial oxygen pressure in arterial blood (PaO_2), oxygen saturation in arterial blood (SaO_2), transcutaneous arterial oxygen saturation (SpO_2) and armpit temperature (T).

Classical vital signs, i.e. T, pulse (P), breathing (B) and blood pressure (BP) did not present categorical instability results in any of the studies. It is suggested though that the patient's lateral position while bathing, especially left lateral decubitus, in patients after coronary artery bypass graft surgery is related with a statistically significant decline when compared with baseline. That is, the comparison of means test for the evaluated parameters before and after left lateral decubitus positioning was significantly different; evidencing a decline in vital signs after left lateral decubitus.

E06 evidences that the patient's left lateral position seems to influence other oxy-hemodynamic variables, including the cardiac index (CI), the oxygen supply index (O_2SI), PaO_2, partial carbon dioxide pressure in arterial blood ($PaCO_2$), mean pulmonary arterial pressure (PAP), mean pulmonary capillary pressure (PCP), central venous pressure (PVC), SaO_2 and SvO_2. This is partially in line with E01, with respect to SvO_2, which demonstrated

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desaturation in the laterality phase of bathing, independently of the decubitus position. On the contrary, E13 did not identify any statistically significant differences in SvO_2 in any position adopted during bathing. No statistically significant differences was found in the studies with regard to the alveolar-capillary oxygen difference ($P(A\text{-}a)O_2$), pulmonary shunt (Qs/Qt) and SpO_2.

The correlation measures confirm physiological logic. In general, the increased oxygen consumption is related with its decrease when returning to the heart and the increased oxygen supply reflects in greater availability for transportation and possible usage by tissues. In this sense, disagreement was found between E06, which reported a positive correlation between SaO_2 and SvO_2, in line with the physiopathological bases, and E13, which reported a negative correlation between these outcomes.

Early bathing after coronary artery bypass graft (CABG) surgery is a factor that declines SvO_2, according to E01 and E13. With regard to the time factor, E13 suggests that prolonged bathing negatively influences SvO_2.

E01 demonstrated that interrupting bathing for 10 minutes in patients after-CABG did not influence any outcomes that were measured or calculated.

The studies agreed that, despite eventual oscillations during bathing, even if statistically relevant, patients recovered afterwards.

E15 suggests that maintaining the water temperature at 40°C benefits patients. In line with other findings, E10 evidenced that, during bathing, SvO_2 declined by less than 10%, following what is recommended as physiologically acceptable, despite the statistical significance of this decline.

Three of the selected studies were published in Brazil, but only E15 submitted the research project to a Research Ethics Committee. In case of E02, this is mitigated by the fact that it was published in 1978, i.e. before the publication of Resolution No 196, issued by the National Health Council in 1996[31]. E10 mentioned neither the consent term nor submission to a Research Ethics Committee. Among international studies, only E01 submitted the research for approval.

With regard to research funding and acknowledgements to private companies, E01 was the only research that presented information in this respect. In that study, both items were emphasized, due to the financial and technical support by a private laboratory which, at the same time, launched a monitor that was similar to the one exclusively produced by a competing laboratory, which was used in the research presented by EO1.

The Oxford[10] classification considers only the research design and, as all studies included in this SR had a quasi-experimental design, they were classified in category. The checklist by Downs & Black[24] is a British instrument that aims to analyze randomized and non-randomized research; the latter are frequent in nursing publications. The maximum score of the checklist is 32 points, divided in five domains and 27 questions, related to: registration (10 questions and 11 points), external validity (3 questions and 3 points); internal validity (7 questions and 7 points); selection bias control (6 questions and 6 points) and power (1 question and 5 points). Among the studies included, the highest scores were 18, 17 and 16 points, for E01, E15 and E10, respectively, i.e. more than half of the possible total score. The remainder varied between 11 and 14 points, i.e. less than half of the possible total score.

DISCUSSION

When weighting the studies' relevance in an evidence quality classification perspective, great difficulty was met to qualify studies that do not use a model mainly developed for a specific research design, that is, randomized controlled clinical trials, as the best research. In fact, this design is not very frequent in nursing research, either because nursing still faces technical, financial or operating limits, or because of its intervention object, – care – seen in different foci, which are not always in line with this design. Repeating that systematic reviews are research about research, however, they are a natural consequence of the original studies. Hence, systematic reviews cannot obtain good results based on badly planned and conducted studies, nor obtain a good classification based on an assessment model that mainly privileges a given research design that is infrequent in nursing publications. The question that emerges from this finding is whether a polyvalent explanatory model exists, independently of the question that originated the research or the population's intrinsic characteristics. Admitting that a given design is the most indicated to answer a certain question goes against weighting this design as weaker evidence.

The studies that best controlled the confounding variables related to bathing were E01 (six controls), E15 and E10 (five controls each). This hierarchy of the best studies is reflected in the analysis of the evidence classification through the checklist by Downs & Black[24], which scored 18, 17 and 16 points, respectively.

The description of the bathing technique did not consider important items, as bathing time was registered in two thirds of the studies. Another piece of information that illustrates the neglected registers about the bathing technique is the fact that half of the selected studies did not present the initial water temperature used and that, among the studies that did (E02, E10 and E15), only E15 developed some strategy to maintain this temperature while bathing. On the other hand, 3°C was identified as the range between the lowest (37°C in E10) and highest (40ºC in E15) initial water temperature.

In this kind of studies, with an enormous and interrelated number of confounding variables, this leads to the huge and not rarely unachievable imperative need to control for these variables, mainly with respect to factors intrinsic to the human being, like the determinants of physiological measures. With regard to temperature, a pipeline of influences occurs, in which environmental temperature affects the water temperature, and both together affect body temperature. When multiplying this system by the other abovementioned factors, which are peculiar for critical patients, a challenge emerges which the profession needs to overcome.

As to the way outcomes were obtained, directly measured (71.8) invasive outcomes (65.6%) were preferred. Invasive outcomes are those that demanded the penetration of a particular device into the skin, mucosa, tissue or vascular bed. This information indirectly reflects the highly critical conditions of patients in the selected studies' samples.

E06 and E13 presented opposite results when correlating SaO2 with SvO2 as, while the first identified a positive correlation, the second found a negative one. Despite the low evidence classification for both studies, the first is favored not only by physiology, but also by the better score, mainly in terms of internal validity, with five and three points, respectively, on the Downs & Black checklist[24].

Hence, the plurality of information from the selected studies does not permit a decisive recipe of indications and contraindications in adult critical hospitalized patients. The findings are contradictory when confronted with information found even in classical textbooks.

As the Oxford scale does not provide further details or analysis of the quasi-experiments, the researchers decided to use the checklist as well, which covers randomized and non-randomized designs. Nevertheless, the issue was not exclusively the research design, but the quality with which the research was conducted, mainly with regard to the control of confounding variables, selection bias, follow-up, sampling power and fragile records, also because other systematic reviews identified errors in the studies, even in randomized controlled trials.

Nursing research problems derive from different sources, given the range of interrelations between the patient, family, science itself and institutions. These four origins constitute the pillars for the formulation of a research problem: nursing praxis and external scientific evidence. Scientific evidence, in turn, mainly from the 1990's onwards, has been nourished more frequently by the incipient dissemination of evidence-based practice, levered by the socialization of primary research results through electronic media. On the other hand, the main goal is for findings to support decision-making and eventually be incorporated into practice, naturally submitted to constant critical assessment. Likewise, the premise of the evidence-based practice movement is that research results return to the research problem sources. In this sense, the relevance of negative results should be admitted, as decision-making involves the exclusion of measures that will not benefit patients in the last instance. In other words, earlier negative results minimize the possibility of present and future errors.

With regard to the study theme – oxy-hemodynamic effects of bed bathing for adult hospitalized patients in critical conditions – nursing's superficial approach of this theme was evidenced. Different publications are found involving this population and intervention. Other equally important outcomes are analyzed though, such as patient and family satisfaction, psychometric aspects in general, infection control, cost-effectiveness relations of bathing, among others. The focus should be distinguished from the research question though, as this theme can and should be addressed from different perspectives. To specifically answer the present research question, however, about physiological reactions, which depend on a detailed approach from the conception until the inferences made from the results, available references are limited, inconsistent and controversial. In this sense, there is no other possibility to obtain these answers than through well-conducted and critical clinical research, given the countless variables that need to be controlled for. Hence, the lack of scientific production was frustrating but also stimulating. As no kind of restriction or direction was imposed on publications in any areas or years, any professional group could discuss something that is peculiar to nursing, i.e. bathing. It was verified, and this is a good omen, that it are nurses who are writing about bathing. On the other hands, nursing has been struggling for its social acknowledgement for a long time, to have its specificity recognized. And, exactly in a procedure that is specific to nursing, part of its daily tasks and a legally attributed responsibility, the profession does not explore its full dimension. Consequently, with regard to possible damage caused by bathing adult hospitalized patients in critical conditions, considering the oxy-hemodynamic aspects, international nursing still owns the response. It would be unsuitable to go deeper into the discussion about basic human needs[32], based on the theory of human motivation[33], ranked into five levels: physiological, safety or protection, social, esteem and self-accomplishment. In this respect, complying with needs like self-esteem and safety demands, in principle, the stabilization of vital functions. The precedent nature of certain physiological needs, like in the case of oxygenation, outlines a peculiar organization and adaptation process of the body /organism to (internal and external) environmental and systems balance.

This review's legacy may be that it confirms the viability of this method and identifies gaps in scientific nursing production as, in line with the above, negative research results need to be valued, considering their present and future influences.

At the end of this SR, establishing a detailed pipeline for bathing adult hospitalized patients was neither possible nor intended. Patients seem to benefit from some guidelines though: avoid bathing within less than 4 h after heart surgery; maintain the water temperature constant at 40°C; attempt to keep the patient in the lateral decubitus position for the shortest possible time and finish bathing within 20 minutes.

CONCLUSION

Based on these study findings, operative measures could be identified that would act as risk factors: bathing within less than 4h after the heart surgery, prolonged lateral decubitus positioning and bathing time of more than 20 minutes. Maintaining the bathing water temperature at 40°C was identified as a protective factor. Strategies should be used that maximize protection rates, as well as other that minimize risk rates.

The above suggestions are not based on scientific evidence classified as strong according to the current model. Hence, they are not irrefutable recommendations, considering the sample plurality which, among other characteristics, involves clinical and surgical patients.

There is an imminent need for further publications about the effects of nursing activities in daily care practice on the physiological aspects of critical hospitalized patients. These need to be conducted in a planned, conscientious, critical and ethical way, including measures to minimize threats against the internal and external validity of their findings and available in a wide range of scientific knowledge dissemination media all over the world.

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