Construction of a nursing management program for early fluid resuscitation in patients with acute pancreatitis: A Delphi study in China

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Research Article

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Abstract

Aim and Objectives:

To construct a set of scientific and feasible nursing management protocols for early fluid resuscitation in acute pancreatitis patients who can be used to guide clinical practice and enhance the treatment efficacy in these patients.

Background

Fluid resuscitation is a key means of early treatment for AP patients and has become a clinical consensus. Nurses are important practitioners of fluid resuscitation, and there is a lack of specific enforceable nursing management programs.

Methods

Through literature research, on-site research, semi-structured interviews, and other preliminary preparations of the first draft of the nursing management program for early fluid resuscitation in acute pancreatitis, the Delphi method was used to conduct two rounds of correspondence with medical and nursing experts, and then statistically analyzed.

Results

Fifteen and 14 questionnaires were distributed in two rounds, respectively, and 15 and 14 questionnaires were recovered, respectively. The positive coefficient of experts was 100%, the authority coefficient was 0.970 and 0.975, respectively; the importance assignment was $x \pm s$; the coefficient of variation coefficient was 0.05–0.21 and 0.00–0.20, respectively; and Kendall's harmony coefficient was 0.05, with a test level of $\alpha = 0.05$. A total of 5 primary indicators, 11 secondary indicators, and 36 tertiary indicators were used to construct the Nursing Management Program for Early Fluid Resuscitation in Acute Pancreatitis.

Conclusions

The constructed nursing management plan for early fluid resuscitation in acute pancreatitis patients puts forward clear requirements and standards for nursing care in the early stage of AP treatment. This plan is in line with the principles of science and operability, has good clinical application and promotion value, and can promote standardized management of early fluid resuscitation in patients with acute pancreatitis.

1 INTRODUCTION

Acute pancreatitis (AP) is a disease caused by the abnormal activation of pancreatic enzymes to produce digestive effects on the pancreas itself and the surrounding organs; this disease is characterized mainly by local inflammatory reactions in the pancreas, occurs at an early stage within two weeks of onset, and is clinically characterized by systemic inflammatory response syndrome (SIRS), the incidence of which is increasing [1–2]. The persistence of early SIRS can lead to multiple-organ dysfunction syndrome (MODS), which constitutes the first peak of clinical mortality in AP patients. Most patients initially experience mild pancreatitis, but 15–20% develop moderate or severe pancreatitis with a mortality rate of 20–40% [3–4]. Therefore, the initiation of early fluid resuscitation should be considered for AP patients of all severities [5]. Early goal-directed fluid therapy within the first 48 h is not only helpful in protecting pancreatic perfusion but also in improving microcirculation in organs such as the kidneys and the heart, reducing the incidence of pancreatic necrosis, MODS, and morbidity, and mortality. Thus, fluid resuscitation constitutes the cornerstone of early AP treatment [6–9] and is the intervention with the greatest potential to enhance clinical outcomes [10–11]. However, it is essential to dynamically monitor all resuscitation indices during fluid resuscitation and to strike a good balance between early and rapid volume expansion and the prevention of fluid overload. The quality of fluid resuscitation implementation is closely linked to nursing care, but there is still significant variation and nonadherence in the early management of AP, particularly in areas where the evidence is unclear and of low quality [12]. Updated guidelines in recent years [1] make reference to goal-directed fluid resuscitation. However, how caregivers can approach goal-directed fluid resuscitation and what specific aspects of good resuscitation should be emphasized are not specified. Therefore, until stronger high-quality evidence emerges, a nursing protocol for early fluid resuscitation in acute pancreatitis patients will be developed by combining existing available evidence, experience, and real-life practice patterns. This protocol aims to provide a reference for promoting standardized management of early fluid resuscitation in acute pancreatitis patients.

2 METHODS

2.1 Design

The Delphi process typically involves two or more rounds of questionnaires [13]. In this study, we utilized a modified Delphi technique to collect experts' opinions regarding evaluation indices for early fluid resuscitation in acute pancreatitis patients. The entire study was divided into two phases: Pre-study Phase: The initial draft of the evaluation indices for early fluid resuscitation in acute pancreatitis was formulated through a combination of literature review and semi-structured interviews, which replaced the traditional first-round survey. Delphi Stage: Based on the framework established in the initial draft of the evaluation indices, a Delphi questionnaire was developed, and two rounds of Delphi surveys were conducted to achieve a consensus.

2.2 Formation of the first draft of an early fluid resuscitation program for acute pancreatitis

2.2.1 Literature study

The PubMed, Medline, Web of Science, Cochrane Library, CNKI, and Wanfang databases were systematically searched from the inception of the databases up to June 2023. The search strategy involved a combination of subject words and free words. The methods employed included searching for relevant systematic evaluations, meta-analyses, and pertinent original research papers. Titles, abstracts, keywords, and references of these papers were analyzed to identify keywords for the literature search. Synonyms were also expanded based on the retrieved articles. The primary search terms used were “acute pancreatitis,” “fluid resuscit*,” “fluid therap*,” “intravenous fluid*,” “intravenous resuscit*,” “nursing,” “delphi method,” “indicators,” “programme*,” and others. Studies related to acute pancreatitis published in either English or Chinese were considered for inclusion. Additionally, we incorporated relevant sources such as the Expert Consensus on Prevention and Interruption of Emergency Care in Severe Acute Pancreatitis [14], the Chinese Guidelines for the Diagnosis and Treatment of Acute Pancreatitis (2021) [1], the Expert Consensus on Emergency Diagnosis and Treatment of Acute Pancreatitis [15], the 2019 WSES guidelines, and more [16–19]. Following the SMART screening principle in health management performance evaluation theory [20], relevant program indicators were initially extracted, forming a pool of indicator entries for the nursing management program of early fluid resuscitation in acute pancreatitis patients.

2.2.2 Semi-structured interviews

A purposive sampling approach was utilized, and sample information saturation was the guiding principle for semi-structured interviews conducted with eight specialists and five specialist nurses from related fields in two comprehensive tertiary hospitals located in two provincial capital cities in China. The interview outline was established through multiple discussions within the group and included the following key questions: (1) What components do you believe should be incorporated into the workflow and specific content of early fluid resuscitation nursing care for acute pancreatitis? (2) In what ways do you propose the quality of early fluid resuscitation care for acute pancreatitis should be assessed, and what criteria should be used? (3) Which nursing factors do you anticipate will influence the quality of early fluid resuscitation in patients with acute pancreatitis? (4) What shortcomings do you perceive in the current approach or content of early fluid resuscitation for acute pancreatitis? (5) What actions do you recommend to enhance and improve the quality of fluid resuscitation care for acute pancreatitis? The sample size for the interviews was determined by the criterion of adding two additional participants after reaching a point where repeated information was obtained, and no new themes or insights emerged during the interviews. By combining the previously collected terms and indicators, which were identified through on-site research, and subsequently categorizing, refining, and summarizing them, a preliminary draft of the early fluid resuscitation nursing management program for acute pancreatitis was developed. This draft included 4 primary indicators, 12 secondary indicators, and 37 tertiary indicators. To ensure its quality, four experts who possessed extensive experience in the diagnosis, treatment, and nursing care of acute pancreatitis evaluated the readability and feasibility of this preliminary program draft.

2.3 Delphi process

2.3.1 The expert panel

The experts who took part in the Delphi survey were drawn from diverse regions and organizations across China. The criteria for their inclusion were as follows: Education: Possession of a bachelor's degree or higher. Title: Holding a position of associate senior or higher. Work Experience and Years of Experience: A minimum of 10 years of experience in clinical or nursing work within the relevant specialty area, specifically in a tertiary general hospital. Voluntary Participation: Willingness to participate in the survey on a voluntary basis. Fifteen experts were ultimately included, 10 (66.67%) of whom were engaged in clinical medical work and 5 (33.33%) of whom were engaged in clinical nursing work. The average age was 43.13 ± 3.68 years, and the average work experience was 15.80 ± 4.20 years. The demographic data of the individuals included in the Delphi panel are shown in Table 1.

Table 1
Demographics of the Panels of Patients

Characteristics	**Round 1 (n = 15)** n (%)	**Round 2 (n = 14)** n (%)
Gender		
Male	10 (66.67)	10 (71.43)
Female	5 (33.33)	4 (28.57)
Age(years)		
< 40	3 (20.00)	3 (21.43)
40–50	12 (80.00)	11 (78.57)
Educational background		
Bachelor's degree	2 (13.33)	1 (7.14)
Master's degree	8 (53.33)	8 (57.14)
Doctoral degree	5 (33.33)	5 (35.71)
Profession titles		
Senior	2 (13.33)	2 (14.29)
Associate senior	13 (86.67)	12 (85.71)
Professional experience (years)		
10-<20	12 (80.00)	12 (85.71)
20–30	3 (20.00)	2 (14.29)
Mentor type		
Master supervisor	12 (80.00)	11 (78.57)
PhD supervisor	3 (20.00)	3 (21.43)

2.3.2 Data collection

Based on the elements of the program obtained in the first draft, a questionnaire was developed for experts on early fluid resuscitation care programs for acute pancreatitis. The questionnaire consisted of three parts: general information about the expert, the main text, and a self-evaluation form for the expert. The questionnaire used a 5-point Likert scale ranging from 5 (very important) to 1 (very unimportant) to assess the degree of importance of each indicator. Columns were included for “modification” and “proposal for adding new program indicators” to allow experts to provide input on modifying or removing existing indicators and suggesting new indicators not originally included in the questionnaire. Experts had the opportunity to propose modifications, deletions, or additions to the indicators. Two rounds of Delphi expert correspondence were carried out in July and August 2023. Both rounds were distributed offline or via email by the subject leader, and participants were requested to return the completed questionnaires either in paper format or through email within 1 week. The Delphi method was employed to calculate the weights of the indicators [21] Indicators with a mean importance rating of ≥ 4.0 and a coefficient of variation of ≤ 0.25 were retained as screening criteria. Additionally, there needed to be at least 75% agreement among the experts. In cases where an indicator met the criteria for deletion, the group members discussed it before making a final decision to prevent the removal of important indicators. We added, merged and modified some of the entries according to the experts’ opinions and reformulated the questionnaire for the second round of correspondence. The two rounds of correspondence questionnaires were collated and analyzed at the end of the two rounds to ultimately form the nursing management plan for early fluid resuscitation in acute pancreatitis patients.

2.3.3 Data analysis

Statistical analysis employed SPSS 25.0 software. Descriptive analyses utilized means, standard deviations, coefficients of variation, and proportions. The effective recovery rate of the questionnaire conveyed the degree of expert positivity. Expert authority was assessed based on judgment and familiarity with the issue. The Kendall harmony coefficient quantified the degree of coordination of expert opinions.

2.3.4 Ethical considerations

The study received approval from the hospital’s medical ethics committee (ethics approval number YXLL-2023–113). Participants were provided with assurances regarding the voluntary nature of their participation and the anonymity and confidentiality of their data.

3 RESULTS

3.1 Reliability judgment of the results of the expert correspondence

3.1.1 Degree of expert activism

In this study, 15 and 14 questionnaires were distributed during the two rounds of expert consultation, and 15 and 14 valid questionnaires were collected, respectively, for a valid recovery rate of 100%. Thirteen experts—86.67% —provided specific comments in the first round of correspondence, and three experts—21.43% —provided comments in the second round of correspondence.

3.1.2 Degree of expert authority

The degree of expert authority (Cr) is determined by the basis for judgment (Ca) and the expert's familiarity with the program indicators under investigation (Cs). The formula for calculating Cr is as follows: Cr = (Ca + Cs)/2. In this study, the experts' basis for judgment (Ca) in the two rounds of correspondence was 0.993 and 0.993. The familiarity with the program indicators (Cs) was 0.947 and 0.957. Therefore, the coefficients of authority (Cr) were 0.970 and 0.975 for the respective rounds.

3.1.3 Degree of harmonization of expert advice

It is expressed through the coefficient of variation (CV) and coordination coefficient. The CV of the two rounds of expert correspondence in this study ranged from 0.05–0.21 and 0.00–0.20. The coordination coefficient is evaluated by Kendall's harmony coefficient, and the expert coordination coefficients of all levels of indices in this study are 0.166–0.335 and 0.189–0.364, respectively. The P values of the first, second, and third level indices are < 0.05 according to the test of Kendall's harmony coefficient, which is statistically significant. The degree of coordination of the expert correspondence is considered good (Table 2).

Table 2
Expert coordination factor

sports event	Number of indicators	Kendall's harmony coefficient	chi-square (math.)	P value
First round (of match, or election)				
Level 1 indicators	4	0.335	15.092	0.002
Secondary indicators	12	0.166	27.390	0.004
Tertiary indicators	37	0.179	96.553	0.000
Second round (of match, or election)				
Level 1 indicators	5	0.364	20.379	0.000
Secondary indicators	11	0.234	32.742	0.000
Tertiary indicators	36	0.189	92.726	0.000

3.2 Results of the expert inquiry

3.2.1 Results of the first round of expert correspondence

In the initial round of the Delphi survey, experts evaluated the initial draft of the nursing management program for early fluid resuscitation in acute pancreatitis patients. This evaluation included 4 primary indicators, 12 secondary indicators, and 37 tertiary indicators, as detailed in Table 3. The first round garnered fifty-one comments. Subsequently, the program underwent revision and refinement by the research team. This process involved a thorough examination of expert recommendations and ensuing discussions. During this revision, three new protocol indicators, specifically those pertaining to the use of anticoagulants, use of antihypertensives, and the rate of blood glucose decline, were not endorsed, as they fell beyond the study's scope. Additionally, one indicator was divided, two indicators were combined, one new indicator was introduced, and eleven adjustments were made to the wording. Furthermore, two items that did not meet the 75% protocol threshold were removed. All the program indicators that were retained emerged from the second round of expert consultations.

Table 3
Results of the first round of expert consultation

Subjects	Mean ± SD	CV	Proportion scored ≥ 4 (%)
1 Admission assessment and disposition	4.93 ± 0.26	0.05	100
1.1 Basic patient assessment	4.33 ± 0.82	0.19	80.00
1.1.1 Time of onset	4.53 ± 0.64	0.14	93.33
1.1.2 Causes	4.27 ± 0.70	0.16	86.67
1.1.3 Weight	4.80 ± 0.41	0.09	100
1.2 Assessment of the patient’s previous treatment	4.00 ± 0.53	0.13	86.67
1.2.1 Diagnosis of AP with or without fluid replacement	4.47 ± 0.74	0.17	86.67
1.2.2 When to start rehydration	4.27 ± 0.88	0.21	80.00
1.2.3 Type, amount and rate of rehydrated fluid	4.33 ± 0.82	0.19	80.00
1.3 Initial assessment of patient severity	4.60 ± 0.63	0.14	93.33
1.3.1 Clinical assessment (age, comorbidities, hemodynamic status, urine output, etc.)	4.60 ± 0.63	0.14	93.33
1.3.2 Use of the revised Atlanta classification	4.33 ± 0.82	0.19	80.00
1.3.3 Laboratory tests (hematocrit, serum urea nitrogen, C-reactive protein level, lactate, etc.)	4.53 ± 0.64	0.14	93.33
1.3.4 Define the criteria for determining hypovolaemia	4.93 ± 0.26	0.05	100
1.4 Immediate disposal	4.67 ± 0.62	0.13	93.33
1.4.1 Immediate initiation of early fluid resuscitation	4.80 ± 0.41	0.09	100
1.4.2 Establish appropriate resuscitation access according to the patient's condition and vascular conditions	4.47 ± 0.52	0.12	100

Subjects	Mean ± SD	CV	Proportion scored ≥ 4 (%)
2 Rehydration strategy	4.47 ± 0.74	0.17	86.67
2.1 Types of rehydration	4.27 ± 0.80	0.19	80.00
2.1.1 Preferred balanced saline solutions such as lactated Ringer’s solution for infusion	4.60 ± 0.51	0.11	100
2.1.2 Artificial colloidal solutions such as hydroxyethyl are not recommended due to increased risk of organ failure	4.20 ± 0.68	0.16	86.67
2.1.3 If pancreatitis is caused by hypercalcaemia, avoid calcium-containing Ringer's solution	4.13 ± 0.92	0.22	66.67
2.1.4 Colloidal preferential albumin, crystalloid/colloid = 3:1, fluid overload or tissue interstitial oedema, increase colloid ratio (1:1–2)	3.87 ± 0.74	0.19	66.67
2.1.5 Principle: crystal before gel, salt before sugar, potassium supplementation at the sight of urine	4.67 ± 0.62	0.13	93.33
2.2 Rate of rehydration	4.53 ± 0.52	0.11	100
2.2.1 Failure to meet hypovolemic indicators, titrated at 2–3 mL/kg/h	4.13 ± 0.74	0.18	80.00
2.2.2 Meet hypovolemic targets, titrate at 5–10 mL/kg/h and reduce fluid rate to 2–3 mL/kg/h when resuscitation targets are met	4.40 ± 0.63	0.14	93.33
2.2.3 If refractory hypovolemic develops or resuscitation goals are not met at 12 h, reduce the fluid rate to 2–3mL/kg/h and notify the physician of relevant consultations	4.53 ± 0.64	0.14	93.33
2.2.4 The presence of hypovolemic with complications of fluid overload should be treated according to the clinical judgement of the physician, and in difficult cases, relevant consultations will be held	4.53 ± 0.64	0.14	93.33
2.2.5 Complications of fluid over-hydration, lowering or stopping fluid infusion, timely reporting to the doctor, and co-operating with the doctor in the use of diuretics and/or oxygen as required, as well as ECG, chest X-ray and blood gas analysis	4.53 ± 0.64	0.14	93.33
2.3 Rehydration volume	4.53 ± 0.64	0.14	93.33
2.3.1 Knowing that in most cases resuscitation goals can be met with 2.5 4L of fluid in the first 24 hours, but that some patients may need up to 5L or more per day in the initial phase	4.40 ± 0.85	0.21	86.67
2.3.2 If the amount of medically prescribed fluid is insufficient, ask the doctor promptly	4.27 ± 0.59	0.14	93.33

Subjects	Mean ± SD	CV	Proportion scored ≥ 4 (%)
2.3.3 Knowing that too much fluid may lead to multiple complications and strengthening monitoring	4.33 ± 0.72	0.17	86.67
3 Rehydration monitoring	4.40 ± 0.63	0.14	93.33
3.1 Monitoring projects	4.33 ± 0.82	0.19	80.00
3.1.1 Vital signs, urine output	4.87 ± 0.35	0.07	100
3.1.2 Blood tests (haematocrit, white blood cell count, urea nitrogen and creatinine, etc.) at 12 hours (± 4), 24 hours (± 4), 48 hours (± 4) and 72 hours (± 4) as required, and 4–6 hours monitoring if on active fluid resuscitation	4.67 ± 0.62	0.13	93.33
3.1.3 Depending on the patient's condition, use ambulatory monitoring tools to guide fluid resuscitation if necessary, e.g. volume per beat (SV), volume per beat variability (SVV), pulse pressure variability (PPV) and cardiac ultrasound	4.00 ± 0.65	0.16	80.00
3.1.4 In patients treated with insulin, especially in hypertriglyceridemic acute pancreatitis (HTG-AP), note the need for strict monitoring of blood glucose to keep it below 11.1 mmol/L, preferably at 6.1–8.3 mmol/L.	4.33 ± 0.72	0.17	86.67
3.2 Significance of monitoring	4.27 ± 0.80	0.19	80.00
3.2.1 Every 4–6 h, assess whether the patient has achieved 2 or more of the following resuscitation goals: heart rate < 120 beats/min, urine output > 0.5-1 ml-kg-1-h-1, mean arterial pressure 65–85 mmHg, erythrocyte product maintained at 35%-44%, urea nitrogen < 7.14 mmol/L.	4.67 ± 0.49	0.10	100
3.2.2 Focus on patient regression (number of hours patients reach resuscitation endpoints, proportion converted to SAP, mortality)	4.00 ± 0.65	0.16	80.00
3.3 Vigilance against complications of fluid over-hydration	4.53 ± 0.74	0.16	86.67
3.3.1 Observe for dyspnea, shortness of breath, chest congestion, shortness of breath, sit-up breathing, coughing up pink foamy sputum, etc.	4.60 ± 0.74	0.16	86.67
3.3.2 Patients with SAP may have comorbid ACS and should be monitored for changes in intra-abdominal pressure and recorded	4.47 ± 0.74	0.17	86.67
4 Health education	4.07 ± 0.70	0.17	80.00

Subjects	Mean ± SD	CV	Proportion scored ≥ 4 (%)
4.1 Knowledge of fluid resuscitation	4.00 ± 0.65	0.16	80.00
4.1.1 Purpose of fluid resuscitation	4.20 ± 0.77	0.18	80.00
4.1.2 Time required for fluid resuscitation	4.20 ± 0.77	0.18	80.00
4.2 Matters requiring co-operation	4.07 ± 0.59	0.15	86.67
4.2.1 No arbitrary adjustment of drip rate	4.13 ± 0.74	0.18	80.00
4.2.2 Possible discomfort and countermeasures	4.20 ± 0.77	0.18	80.00

3.2.2 Results of the second round of expert correspondence

During the subsequent round of correspondence, consensus was achieved for all program indicators, guided by predefined criteria. Only minor wording adjustments were made, and no additions or deletions occurred. Consequently, a total of five primary indicators, 11 secondary indicators, and 36 tertiary indicators were conclusively established, as outlined in Table 4.

Table 4
Results of the second round of expert consultation

Subjects	Mean ± SD	CV	Proportion scored ≥ 4 (%)
1 Initial in-hospital assessment	4.93 ±0.27	0.05	100
1.1 Basic patient assessment	4.57 ±0.65	0.14	92.86
1.1.1 Time of onset	4.64 ±0.50	0.11	100
1.1.2 Medical history	4.29 ±0.61	0.14	92.86
1.1.3 Weight/last weight of bedridden patient	4.86 ±0.36	0.07	100
1.2 Assessment of the patient's previous treatment	4.21 ±0.58	0.14	92.86
1.2.1 Diagnosis of AP with or without fluid replacement	4.57 ±0.65	0.14	92.86
1.2.2 Time to start rehydration	4.43 ±0.76	0.17	85.71
1.2.3 Type and amount of fluid that has been rehydrated	4.43 ±0.65	0.15	92.86
1.3 Initial assessment of patient severity	4.86 ±0.36	0.07	100
1.3.1 Clinical assessment (age, comorbidities, hemodynamic status, urine output, etc.)	4.71 ±0.47	0.10	100
1.3.2 Laboratory tests (hematocrit, serum urea nitrogen, C-reactive protein level, lactate, etc.)	4.57 ±0.65	0.14	92.86
1.3.3 Identifying SSAP using BISAP scores	4.50 ±0.65	0.14	92.86
1.3.4 Define the criteria for determining hypovolaemia	4.93 ±0.27	0.05	100
2 Initial in-hospital disposal	5.00 ±0.00	0.00	100
2.1 Timing of disposal and choice of access	4.86 ±0.36	0.07	100
2.1.1 Immediate initiation of early fluid resuscitation	4.93 ±0.27	0.05	100
2.1.2 Establish appropriate resuscitation access according to the patient's condition and vascular conditions	4.93 ±0.27	0.05	100
3 Rehydration strategies	4.50 ±0.65	0.14	92.86
3.1 Types of rehydration	4.43 ±0.65	0.15	92.86
3.1.1 Preferred balanced saline solutions such as lactated Ringer's solution for infusion	4.71 ±0.47	0.10	100
3.1.2 Artificial colloidal solutions such as hydroxyethyl are not recommended due to increased risk of organ failure	4.36 ±0.50	0.11	100

Subjects	Mean ± SD	CV	Proportion scored ≥ 4 (%)
3.1.3 Principle: crystal before gel, salt before sugar, potassium supplementation at the sight of urine	4.79 ±0.43	0.09	100
3.2 Rate of rehydration	4.64 ±0.50	0.11	100
3.2.1 Infusion at 2–3 mL/kg/h without hypovolemic indicators	4.29 ±0.61	0.14	92.86
3.2.2 Meet hypovolemic targets and infuse at 5–10 mL/kg/h, reducing fluid rate to 2–3 mL/kg/h once resuscitation targets have been met	4.57 ±0.51	0.11	100
3.2.3 If refractory hypotension occurs or resuscitation goals are not met at 6 h, notify the physician for relevant consultation	4.45 ±0.65	0.15	92.86
3.2.4 The presence of hypovolaemia with the complication of fluid overload should be treated according to the physician's clinical judgment and consultative opinion	4.64 ±0.50	0.11	100
3.2.5 In the event of complications from over-hydration, reduce or stop the fluid infusion, report to the doctor promptly, and cooperate with treatment as required	4.57 ±0.51	0.11	100
3.3 Rehydration volume	4.50 ±0.65	0.14	92.86
3.3.1 In most cases, resuscitation goals are met with 2.5 4 L of fluid in the first 24 h, but some patients may require up to 5 L of fluid per day or more in the initial phase	4.40 ±0.78	0.20	85.71
3.3.2 If the amount of medically prescribed fluid is insufficient, ask the doctor promptly			
3.3.3 Knowing that too much fluid may lead to multiple complications and strengthening monitoring			
4 Rehydration monitoring	4.57 ±0.51	0.11	100
4.1 Effectiveness monitoring	4.57 ±0.51	0.11	100
4.1.1 Vital signs, urine output	4.79 ±0.43	0.09	100
4.1.2 Blood tests (hematocrit, white blood cell count, urea nitrogen and creatinine, etc.) at 12 h (± 4), 24 h (± 4), 48 h (± 4) and 72 h (± 4) as needed, and 4–6 h monitoring if on active fluid resuscitation	4.64 ±0.63	0.14	92.86
4.1.3 Depending on the patient's condition, use ambulatory monitoring tools to guide fluid resuscitation if necessary, e.g. volume per beat (SV), volume per beat variability (SVV), pulse pressure variability (PPV) and cardiac ultrasound	4.14 ±0.66	0.16	85.71
4.1.4 In patients treated with insulin, especially in hypertriglyceridemic acute pancreatitis (HTG-AP), note the need for strict monitoring of blood glucose to keep it below 11.1 mmol/L, preferably at 6.1–8.3 mmol/L.	4.43 ±0.65	0.15	92.86

Subjects	Mean ± SD	CV	Proportion scored ≥ 4 (%)
4.1.5 Every 4–6 h, assess whether the patient has achieved 2 or more of the following resuscitation goals: heart rate < 120 beats/min, urine output > 0.5–1 ml-kg^{-1}-h-1, mean arterial pressure 65–85 mmHg, erythrocyte product maintained at 35–44%, urea nitrogen < 7.14 mmol/L	4.86 ±0.36	0.07	100
4.1.6 Focus on patient regression (number of hours patients reach resuscitation endpoints, mortality)	4.00 ±0.68	0.17	78.57
4.2 Complication monitoring	4.57 ±0.65	0.14	92.86
4.2.1 Monitoring of CVP	4.71 ±0.47	0.10	100
4.2.2 Observe for dyspnea, shortness of breath, chest congestion, shortness of breath, sitting breathing, coughing up pink foamy sputum, etc.	4.64 ±0.63	0.14	92.86
4.2.3 Patients with SAP may have comorbid ACS and should be monitored for changes in intra-abdominal pressure and recorded	4.50 ±0.65	0.14	92.86
5 Health education	4.21 ±0.58	0.14	92.86
5.1 Knowledge of fluid resuscitation	4.14 ±0.53	0.13	92.86
5.1.1 Purpose of fluid resuscitation	4.29 ±0.73	0.17	85.71
5.1.2 Time needed for fluid resuscitation	4.36 ±0.63	0.15	92.86
5.2 Matters requiring co-operation	4.14 ±0.53	0.13	92.86
5.2.1 No arbitrary adjustment of drip rate	4.29 ±0.61	0.14	92.86
5.2.2 Possible discomfort and countermeasures	4.36 ±0.63	0.15	92.86

4 DISCUSSION

4.1 The need for a nursing management programme for early fluid resuscitation in AP patients

AP, especially SAP, is characterized by the release of proinflammatory mediators, the vasoconstriction of small arteries, and the induction of tissue hypoxia, which can lead to mixed hypovolemic and distributive shock and ultimately to SIRS and MODS [22]. In particular, early fluid resuscitation assumes a pivotal role within 24–48 h post onset [23]. Various investigations [24] indicate that fluid resuscitation can also be carried out through enteral (nasoenteric and colorectal) means. This topic explores fluid resuscitation through the traditional intravenous route. Goal-directed fluid management necessitates a continual assessment of the benefits and drawbacks of enhancing perfusion against fluid retention. Unregulated

fluid resuscitation heightens the risk of under- or over-hydration, leading to increased complications and mortality. Consequently, standardized fluid resuscitation has emerged as a pivotal step in the treatment of patients with AP. Nurses, serving as primary implementers, monitors, and administrators of AP fluid resuscitation, are integral to its management. Their proficiency in goal-directed fluid resuscitation and its application significantly influences patient outcomes and prognoses. Presently, numerous guidelines [1, 16, 17, 23, 25, 26] underscore the significance of fluid resuscitation and the concept of goal-directed fluid resuscitation. However, specific interventions such as the type, volume, and rate of fluid rehydration lack robust evidence, and a consensus [27]is absent. This absence leaves nurses without a standard reference in clinical practice. The necessity [28]of evidence-based standardization in AP management is evident. Thus, developing a scientifically based nursing management program for AP fluid resuscitation is essential to enhance the quality of early fluid resuscitation care in AP.

4.2 The AP early fluid resuscitation care management program is scientifically sound and reliable

In this study, we gathered data pertaining to early fluid resuscitation in AP patients from relevant guidelines, consensuses, systematic assessments, and evidence summaries. We complemented these sources with semi-structured interviews to gain insights and recommendations regarding the quality of nursing care for fluid resuscitation in AP patients. These interviews were conducted with medical doctors and nurses in related fields. This approach was employed to address the gaps in the literature review and ensure that the initial draft of the proposed indicator system was comprehensive, systematic, and practical. Two rounds of expert correspondence were conducted using the Delphi method. We selected 15 experts who demonstrated expertise and authority based on their years of experience, educational backgrounds, and professional titles. The Delphi method, a well-established correspondence technique, was employed to assess the reliability of the study. This assessment considered experts' motivation, authority, and level of agreement. The results of the correspondence test revealed that the experts displayed high motivation and authority. Their opinions regarding the research content exhibited minimal fluctuations. Additionally, Kendall's harmony coefficient indicated a high level of consensus among the experts, making the research outcomes reliable. Furthermore, consensus-based percentages were used to reinforce the reliability of the study results.

4.3 The program covers the whole process of fluid resuscitation care management for AP patients after admission and is highly applicable

4.3.1 Assessment as the first step will guide the nurse to initiate timely and precise resuscitation

The program applies to emergency, ward, and intensive care units. In the initial round of communication, experts recommended changing "time of diagnosis" to "time of onset." They believed that "time of onset" would better assist medical staff in assessing the patient's condition and progress initially. It also guides efforts to enhance disease literacy and awareness in the population before or after hospitalization,

minimizing the time gap between illness onset and medical treatment. This approach also helps direct the development of initiatives to enhance disease literacy and awareness in the prehospital or posthospital population, further reducing the time gap between illness onset and when patients seek medical treatment. “Medical history” includes the history of the presenting illness and past medical history, aiding medical staff in identifying potential causes of AP and contraindications to rehydration. Rehydration protocols often consider body weight [29]. Even bedridden patients should have recent weight information obtained from patients or family members, as recommended by experts, to enhance practicality. Assessing prior treatments involves determining whether patients received relevant treatment before evaluation, influencing our protocol to avoid over- or under-rehydration. Furthermore, nurses must assess AP severity in patients. As early-stage AP severity assessment, especially within 24 h, remains unsatisfactorily resolved, expert opinion suggested omitting the phrase “use the revised Atlanta Classification.” According to the Expert Consensus on Prevention and Intervention of Severe Acute Pancreatitis in Emergency Care, it is advisable to include a “suspected severe acute pancreatitis (SSAP)” diagnosis in the current classification criteria to offer timely support and treatment [30]. The APACHE II score, Marshall’s score, Ranson’s score, and SOFA score can assist in early or retrospective AP severity assessments. Although the APACHE II score, Marshall score, Ranson score, SOFA score, etc., can determine AP severity early or retrospectively, they are not widely used in clinical practice due to complexity and inconvenience. However, the BISAP score is considered a practical method for predicting SAP due to its simplicity and accessibility [31]. Of course, these tools should not replace clinical judgment.

4.3.2 Reducing the time lag between attendance and resuscitation initiation is fully controllable for the nurse and seems simple, but it is great

In fact, the first few hours after the onset of the disease are considered crucial for preventing SIRS, progression of MODS and/or worsening of pancreatic necrosis [32]. Moreover, AP is dynamic and can progress to a serious illness, which can be influenced by timely intervention [33]. Early fluid resuscitation is key for achieving the most effective goal-directed fluid resuscitation in AP patients. There were two time intervals between the onset of disease, the time to medical care, and the time to resuscitation initiation. The first time difference is not easy to control, but we can minimize the second time difference between onset and fluid resuscitation, and nurses can minimize the damage to the pancreas and systemic microcirculation induced by the inflammatory cascade response by performing fluid disposal immediately [34–35]. Given its significance, we followed the experts’ advice to divide the primary indicator “admission assessment and management” into two separate indicators: “initial in-hospital assessment” and “initial in-hospital management.” The implementation of “immediate intravenous infusion” can be enhanced through measures like medical and nursing agreement prescriptions, as well as comprehensive packages of medications and medical devices.

4.3.3 As implementers and supervisors of early fluid resuscitation in AP patients, nurses help AP patients meet perfusion needs while avoiding fluid overload

What fluid is chosen to establish resuscitation access, crystalloid or colloid? Most guidelines recommend a balanced salt solution such as Ringer's lactate, which has a more favorable anti-inflammatory effect than 0.9% NaCl for SIRS and C-reactive protein control within 24 h [36]. Therefore, Ringer's lactate was directly adopted in the programme, which also facilitates the stock of self-contained drugs in the nursing units of each hospital. For hydroxyethyl, a common colloid in the clinic, large randomized controlled trials have shown adverse effects such as renal impairment; thus, the current evidence does not support the use of artificial colloids such as hydroxyethyl in SAP patients [37]. The use of colloids in critically ill patients is controversial and needs to be determined by a doctor according to the patient's situation; therefore, according to expert opinion, these patients were excluded. The rate of fluid resuscitation should be goal-oriented according to the guidelines, but there are significant differences among the studies. The Chinese 2021 guidelines [1] specify an initial rate of 5–10 mL/kg/h for the first 24 h. However, there is no specific recommendation regarding the duration of this rate. Some sources suggest a duration of 24 h. It is important to note that administering too much fluid over 24 h has been linked to a worse prognosis [38]. An open-center randomized controlled trial of fluid resuscitation in patients with SAP was published in 2022 in the New England Journal of OLPO-RCTs. This trial investigated the safety and efficacy of weight-based active fluid resuscitation versus moderate fluid resuscitation in the treatment of AP. Active fluid resuscitation involved a push of 20 mL/kg for more than 2 h, followed by 3 mL/kg/h. Moderate fluid resuscitation consisted of a push of 10 mL/kg only when hypovolemia was present, followed by 1.5 mL/kg/h. The study revealed that active fluid resuscitation was associated with a higher risk of volume overload and did not lead to improved clinical outcomes [29]. Initially, the research team favored the moderate fluid resuscitation approach from this study. However, recognizing the potential risk of inadequate resuscitation when using fixed infusion rates, a more tailored approach became necessary. Volume expansion should be adjusted within the first few hours of admission based on a careful assessment of the patient's volume status, especially in severe cases. Consequently, fluids should be initiated at a rate of 5–10 mL/kg/h. If resuscitation goals are achieved at any point during the first 24 h, the fluid rate should be reduced to 2–3 mL/kg/h [1, 39]. It is important to highlight that patients who do not exhibit a rapid clinical response within the initial 6–12 h of fluid therapy may not benefit from large volumes of fluid administration [40]. Five experts believe that reducing the fluid volume after 12 h may cause the total volume of fluid received by patients to increase, so it was discussed that patients who do not show a rapid clinical response after 6 h are advised to slow the drip rate and ask for a relevant consultation. There is also no definitive conclusion about the amount of fluid needed to replenish AP patients, but nurses should be aware that, in most cases, 2.5 4 L of fluid in the first 24 h will achieve the resuscitation goal, but there are people who may need up to 5 L or more per day in the initial phase [41].

In conclusion, acute pancreatitis represents a multifaceted and evolving disease process, highlighting the significance of personalized fluid therapy [42]. Excessive intravenous fluid administration can result in water and salt overload, potentially exacerbating the condition [43]. In the context of critically ill patients, vigilance and meticulous patient monitoring are imperative due to the potential risks associated with improper fluid management [44]. Close clinical and hemodynamic monitoring and a clear definition of resuscitation goals are fundamental. Nurses, as sentinels and end-performers of fluid resuscitation, need

to assess patients frequently, with commonly accepted goals of reversing urine output, treating tachycardia, and hypotension, as well as improving laboratory markers and adjusting management based on clinical findings and trends. Certain laboratory values, such as hematocrit and blood urea nitrogen, have traditionally served as markers for hypovolemia and can offer valuable insights into assessing fluid status. Elevated values upon admission and their subsequent increase during the initial 24 to 48 h may indicate inadequate fluid resuscitation [45]. In cases of SAP, precise fluid therapy adjustments are essential. Similar to other situations requiring substantial fluid management typically encountered in the ICU, a combination of noninvasive clinical assessments, invasive hemodynamic parameters, and laboratory indicators should guide healthcare professionals and nurses during the early stages of SAP. This approach ensures that organ perfusion requirements are met through appropriate fluid administration while mitigating the adverse effects of fluid overload. Furthermore, it is crucial to note that in the specific context of SAP, complications like bowel wall edema and retroperitoneal edema can lead to the development of abdominal compartment syndrome, posing significant challenges [46]. Therefore, intra-abdominal pressure measurements are recommended for patients with abdominal issues to monitor the potential emergence of abdominal compartment syndrome [47].

4.3.4 As health educators for early fluid resuscitation in AP, nurses play an important role in promoting patient compliance in performing fluid therapy

Nurses play a crucial role in developing and implementing health education. Effective health education enables AP patients to gain a comprehensive understanding of the information and purpose behind fluid resuscitation, enhancing their treatment adherence, particularly during the initial active rehydration phase. Nurses should communicate to patients the importance of good compliance for effective early fluid resuscitation treatment. They should refrain from making arbitrary adjustments to the drip rate to prevent any decrease in compliance, which could reduce therapeutic effectiveness. Furthermore, nurses should actively encourage patients to participate in activities that promote patient safety.

5 LIMITATIONS

This study has several limitations. First, only Chinese experts were included in the Delphi Correspondence due to funding and time constraints, but the results of the study are still relevant to other countries. Second, this nursing program involves “in-hospital initial assessment”, “rehydration strategy”, “rehydration monitoring”, etc., which requires nurses to have greater medical knowledge, but it can improve nurses’ sense of professional gain and effectively promote nurses’ career development. However, this approach can greatly improve nurses’ sense of professional gain and effectively promote patients’ clinical outcomes. Finally, the nursing management program for early fluid resuscitation in acute pancreatitis patients developed in this study still involves theoretical research, needs to be tested for its effectiveness and applicability in the clinic, and needs to be continuously revised and improved with the results of practice.

6 CONCLUSION

This study constructed a scientific and credible nursing management programme for early fluid resuscitation in acute pancreatitis (AP) patients who included five primary indicators, 11 secondary indicators, and 36 tertiary indicators. The program provides a set of structured programs to improve the quality of early fluid resuscitation nursing care in AP patients and provides a clear direction of knowledge reserve for nurse induction, as well as a reference basis for nursing manager competence evaluation, training, and appraisal.

Declarations

Ethics approval and consent to participate

The study was approved by Shanxi Bethune Hospital, Shanxi Academy of Medical Sciences Institutional Review Board in accordance with the Declaration of Helsinki. All methods were carried out in accordance with relevant guidelines and regulations. Written informed consent was obtained from all individual patients included in the study.

Consent for publication

Not Applicable

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

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All authors have read and agreed to the published version of the manuscript.

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