

## ORIGINAL ARTICLE

# Development of a CAUTI risk factor evaluation index system for postoperative patients with gynecological malignant tumors

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## Summary

**Purpose:** In this study, we developed a CAUTI risk factor evaluation index system for postoperative patients with gynecologic malignant tumors and provided scientific evidence for the prevention of catheter-related urinary tract infection (CAUTI).

**Methods:** A comprehensive method, including literature review, group discussion and Delphi method, was adopted to establish a CAUTI risk factor evaluation index system for postoperative patients with gynecologic malignant tumors.

**Results:** Two rounds of expert consultations resulted in effective response rates of 100%, with authority coefficients of 0.94, and coordination coefficients of 0.473 and 0.388

respectively ( $p < 0.01$ ). The risk factor indicator system consisted of 4 first-level indicators, 13 second-level indicators, and 56 third-level indicators.

**Conclusion:** The experts showed high enthusiasm, good authority, and coordination. The CAUTI risk factor evaluation index system for postoperative patients with gynecologic malignant tumors is comprehensive and scientific, and could serve as an important guide for assessment and prevention of CAUTI in patients with gynecologic malignant tumor postoperatively.

**Key words:** gynecological malignant tumors, CAUTI, Delphi technique, risk factor

## Introduction

According to a previous study, an increasing trend of prevalence is observed in the surgery for gynecologic malignancies [1], which is the dominant treatment for these patients, causing postoperative bladder dysfunction that induces catheter indwelling [2]. Catheter-associated urinary tract infection (CAUTI) refers to patients, indwelling catheter, or removal of catheter within 48 h of the infection of the urinary system. Data showed that the mean daily rate of CAUTI was 27.05/1000 catheter days in patients with gynecologic malignancy [3], which is worse than NSHN 3.1–7.5/1000 catheter days in the USA and intensive care unit

(ICU) 4.02/1000 catheter days in China [4,5]. CAUTI not only causes a decline in the patient physical and mental health, but also increases the financial burden, which improves the disease prognosis [6]. Although several studies have assessed the risk factors of CAUTI in patients with gynecologic malignancies after surgery, no integrated evaluation system is yet established. Based on the clinical practice guidelines and literature review, this study used the Delphi technique to establish the CAUTI risk factor evaluation index system for patients with gynecologic malignancies after surgery.

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Received: 28/03/2021; Accepted: 22/04/2021

## Methods

### *Establishment of research and coordination groups*

The research group included 5 individuals, 2 senior professional titles, 2 intermediate professional title, and 1 junior professional title. The main assignment of this group was to establish an experts' pool according to the standard of expert selection, design a form for an expert consultation, and statistically analyze the consulting results.

### *Constructing expert consultation questionnaire*

The risk factors of CAUTI in patients with gynecologic malignancies were determined by referring to the clinical guidelines and literature review as well as the clinical practice. Subsequently, 4 first-level indicators, 13 second-level indicators, and 58 third-level indicators were included in the final questionnaire. The research group independently designed the first round of expert consultation form. The consultation form was divided into three parts: Part one was to send an email about the research objective, the concept of risk factors of CAUTI, and the operational process to experts. Part two was about the evaluation scale. Experts were asked to score each item on its relevance to postoperative CAUTI risk factors in patients with gynecologic malignancies based on Likert 5 grading: 1–5 points, more points indicate importance. Part three was about the self-assessment scale, including the evaluation of the influence of judgment on experts. Experts were required to fill in the content of the familiarity of the score in addition to the expert general information questionnaire.

### *Selection and identification of consultants*

According to the requirements and purposes of the Delphi method, experts were required to be familiar, authoritative, and be able to represent the subject as well as to cooperate with the investigation. The number of experts was determined based on the scope of research issues and available resources, and subsequently, 15 experts were included in the study. Expert selected criteria: Bachelor degree or above; Engaged in gynecologic oncology; specialist nursing work; gynecologic oncology specialist medical work; nursing management work for >10 years; Vice-senior or above professional title.

### *Implementation of expert consultation*

Two rounds of expert consultation were completed in this study. The first round of questionnaires was sent to the experts by email. The experts were requested to return the questionnaires by mail within the specified time. After the first round of expert consultation, the questionnaires were recovered, and the researchers followed the principle of indicator screening and deleted the items with arithmetic mean < 3.5 or expert approval degree < 60% and coefficient of variation (CV) > 0.25. The items of opinions proposed by experts were added, modified or deleted subsequently along with the discussion and statistical results of the research group to form the second round of expert consultation table. Concurrently, the expert opinions of the first round were attached, in-

cluding the reasons for the adoption and non-adoption of opinions. Experts referred to the feedback information for judgment and revision. After the second round of expert consultation, questionnaires were recovered, the research team sorted and conducted a statistical analysis of the expert opinions. When the experts' opinions reached a consensus, the consultation was ended.

### *Statistics*

The database of expert consultation results was established by Excel, and SPSS 18.0 statistical software (SPSS Inc., Chicago, IL, USA) was used for data processing. The degree of expert opinion concentration was expressed by the mean, standard deviation, and expert recognition of index importance. The positive coefficient of the expert was expressed by the effective recovery rate of the questionnaire. The degree of expert authority was expressed by the degree of authority coefficient. The degree of coordination of expert opinions was expressed by the coefficient of variation and Kendall coefficient of coordination, and  $p < 0.05$  was considered statistically significant.

## Results

### *Positive co-efficient of experts*

The degree of expert positivity was indicated by the response rate of each round of questionnaires and the proportion of experts making suggestions. The questionnaire recovery rate was 100.0% in both rounds of consultation, and the effective rate was also 100%. In the study, 12 experts put forward suggestions, and 4 experts gave modification opinions, accounting for 80% and 26.7% of the participants, respectively.

### *Degree of expert authority*

Expert authority (Cr) is the arithmetic mean of the expert's familiarity coefficient (Cs) and judgment coefficient (Ca) of the consultation content. In this study, the Cs and Ca of expert consulting were 0.94 and 0.94, respectively, and the authority coefficient (Cr) of expert consultation was 0.94.

### *Degree of coordination of expert opinions*

The Kendall coordination coefficients of the two rounds of consultations were 0.473 and 0.338, respectively, which differed significantly ( $p < 0.01$ ), as assessed by the chi-square test.

### *Screening and modification of indicators*

The degree of concentration of expert opinions was expressed by average values, which were between 0 and 5 points. The greater the mean value, the more important the corresponding index. CV indicated the degree of coordination of all experts on the importance of an item. The smaller the CV,

**Table 1.** Index system of postoperative CAUTI risk factors in patients with gynecologic malignant tumors

Primary indicators	Secondary indicators	Tertiary indicators	Mean value	Standard deviation	CV	Expert recognition degree (%)	
Factors related to gynecologic malignant tumors	Disease	Tumor types	3.80	0.77	0.20	73.33	
		Neoplasm staging	3.73	0.81	0.22	60.00	
	Surgical related factors	Surgery	4.33	0.80	0.18	93.33	
		Scope of surgery	4.40	0.81	0.18	93.33	
		Operation time	4.53	0.50	0.11	100.00	
	Intraoperative accessory nerve injury	Postoperative abdominal infection	4.53	0.50	0.11	100.00	
			4.33	0.80	0.18	93.33	
	Postoperative complications	Postoperative Pelvic infection	4.53	0.50	0.11	100.00	
			4.87	0.35	0.07	100.00	
		Cyst hemorrhagia	Vesicovaginal fistula	5.00	0.00	0.00	100.00
			Rectovaginal fistula	4.80	0.41	0.09	100.00
	Postoperative treatment factors	UT injury	5.00	0.00	0.00	100.00	
			4.80	0.41	0.09	100.00	
		Bladder irrigation	4.80	0.41	0.09	100.00	
			4.80	0.41	0.09	100.00	
Antibiotic use		4.53	0.62	0.14	93.33		
Patient-related factors	Postoperative radiotherapy	4.60	0.61	0.13	93.33		
		4.47	0.90	0.20	86.67		
	Postoperative chemotherapy	Age	4.73	0.45	0.10	100.00	
		Immobilization	4.73	0.59	0.12	93.33	
	Personal profile	Water intake	4.73	0.59	0.12	93.33	
		Urine volume	4.87	0.26	0.05	100.00	
	Preoperative chemotherapy	Ureteral stent	4.33	0.81	0.19	80.00	
		4.40	0.82	0.19	80.00		
	Preoperative radiotherapy	Personal hygienic habit	4.80	0.41	0.09	100.00	
		Menopause or not	4.13	1.12	0.27	73.33	
Hospital stay	4.20	1.06	0.25	80.00			

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Primary indicators	Secondary indicators	Tertiary indicators	Mean value	Standard deviation	CV	Expert recognition degree (%)
Patient-related factors	Accompanying diseases	Diabetes mellitus	4.73	0.59	0.12	93.33
		Immune system disease	4.40	0.62	0.14	86.67
		Lithanguria	4.60	0.72	0.16	86.67
		Kidney failure	4.87	0.55	0.07	100.00
	Laboratory results	Disease of lower motor neuron injury	4.60	0.82	0.18	93.33
		Pyelonephritis	4.60	0.82	0.18	93.33
		Serum leukocyte	4.40	0.81	0.18	93.33
		Serum neutrophils	4.40	0.81	0.18	93.33
		Serum hemoglobin	4.20	0.86	0.20	73.33
		Albumin	3.80	0.96	0.25	60.00
	Medication-related factors	Estrogen level	4.20	1.06	0.25	80.00
		Glucocorticoids	4.47	0.73	0.16	86.67
		Immunosuppressor	4.67	0.72	0.15	86.67
		Urethral catheter material	4.47	0.73	0.16	86.67
Device-related factors	Urethral catheter factors	Catheter diameter	4.33	0.81	0.19	80.00
		Number of catheter cavities	4.00	0.65	0.16	80.00
	Drainage bag-related factors	Position of catheter fixation	4.07	0.76	0.19	86.67
		Maintain the catheter patency	4.73	0.59	0.12	93.33
		Type of drainage bag	3.93	0.99	0.25	60.00
		The position of drainage bag fixation	4.00	0.80	0.20	66.67
Operation-related factors	Intubation factors	Hand hygiene	4.87	0.35	0.07	100.00
		Aseptic operation during intubation	5.00	0.00	0.00	100.00
	Healthcare provider-related factors	Primary success rate of intubation	4.73	0.45	0.10	100.00
		Healthcare provider training	4.93	0.26	0.05	100.00
	Maintenance-related factors	Frequency of catheter replacement	4.80	0.41	0.09	100.00
		Frequency of drainage bag replacement	4.60	0.49	0.11	100.00
		Disinfection of perineum	4.87	0.26	0.05	100.00
		Urinary catheter indwelling time	5.00	0.00	0.00	100.00
		Periodically emptying of urine from the drain bag	4.60	0.49	0.11	100.00
		Maintenance of closed drainage	4.87	0.52	0.11	93.33

CV: coefficient of variation

the higher the degree of coordination of experts. Typically, the average value of importance assignment  $>3.00$  and  $CV <0.35$  were acceptable [7]. Expert recognition referred to the proportion of experts who proposed that the index and the rate of importance in the total number of experts were critical parameters. The greater the proportion of experts, the greater the importance. After the first round of expert consultation, 14 items were deleted, 12 items were added, and 8 items were modified. After the second round of expert consultation, 2 items were deleted and 4 items were modified. In addition, no objection was placed on the contents of the indicators revised in the first round. After two rounds of consultation, experts rated the importance of each indicator. The mean score of the index was 3.73-5 points. The variation coefficient of the index score was 0-0.27. The expert recognition degree was  $\geq 60\%$ . The final formation included 4 primary indicators, 13 secondary indicators, and 54 tertiary indicators (Table 1).

## Discussion

Delphi method is a consulting and decision-making technique developed on the basis of the expert conference method. It widely solicits and converges the opinions of experts through anonymous methods after several cycles of information exchange and feedback modification. Thus, the scope of the application of this study predicts the objective in this study. It has the characteristics of anonymity, extensiveness, and interwheel information feedback, and the results were analyzed statistically [8]. When applying the Delphi method, the choice of experts and the quality of expert consultation need to be considered. The survey is deemed good if the response rate is  $>70\%$  [9]. The higher the response rate, the larger the proportion of experts making the suggestions, which indicated that the experts were enthusiastic. In this study, the effective recovery rate of the two rounds of questionnaires was 100%. Furthermore, experts put forward valuable opinions on the questionnaires, and the participation rate was 80% and 26.7%, respectively, indicating that experts were concerned about and supported this study. In addition, the enthusiasm of participation was high. Typically, the level of  $Cr \geq 0.7$  is acceptable, while  $Cr > 0.8$  indicates that experts have great confidence in the selection of content [10]. The expert authority coefficient of this study reaches 0.94, which indicated that the expert authority of this study was high, and the consulting quality was good, which laid the foundation for the credibility and reliability of this index sys-

tem. The degree of expert opinion coordination could be used to judge the marked difference in the evaluation of the index between experts, as reflected by the Kendall coordination coefficient: 0.473 and 0.338, respectively. The difference was found to be statistically significant, as assessed by the chi-square test, indicating that the expert opinion is consistent and the result is desirable.

Prevention strategies for CAUTI, by the American Academy of Healthcare Epidemiology, proposed that the risk assessment should recognize the need for clinical monitoring. In addition, the risk factors were determined, and then targeted intervention was implemented to reduce the occurrence of CAUTI. Currently, a postoperative unified risk factor evaluation index system for CAUTI is lacking for patients with gynecologic malignant tumors in China. The present study collected the risk factors of CAUTI in postoperative patients with gynecologic malignant tumors during the hospital stay. According to the risk factors of CAUTI prevention and control technology guidelines, the review of the Chinese and foreign databases provided information along with research group discussion. Next, we classified and summarized the information with the objective of establishing an evaluation index system based on comprehensive scientific and feasible principles. This system would select the representative and accessible factors as the index based on the Delphi expert inquiry. Moreover, this study constructed a risk factor evaluation index system of CAUTI that encompassed different aspects of medical care for postoperative patients with gynecologic malignant tumors. Four first-level indicators, including factors related to gynecologic malignant tumors, device, and operation, were identified, while 13 second-level indicators detected the baseline condition of the patients, operation factors, medication, laboratory index, catheter maintenance. This evaluation system is comprised of reasonable structure and comprehensive content, which enables health care providers to respond rapidly to the risk factors of CAUTI with appropriate and effective prevention.

Limitations also existed in this study. The Delphi method adopted in this study is subjective. The experts consulted by letter belong to different fields from seven 3As-grade hospitals in Zhejiang province. Although the subject representation of the experts is good, the geographical representation may not be appropriate. The critical risk factors of postoperative CAUTI in patients with gynecologic malignant tumors were screened. However, the indicators were not defined quantitatively. Thus, the quality and feasibility of the index system need to be explored further and verified in practice.

## Conclusions

In conclusion, the CAUTI risk factor evaluation index system for postoperative patients with gynecologic malignant tumors is comprehensive and scientific, and could serve as an important guide for assessment and prevention of CAUTI in patients with gynecologic malignancies postoperatively.

## Acknowledgements

This work was supported by Medical Health

Science and Technology Project of Zhejiang Provincial Health Commission, Grant number: 2019309946, Development and validation of catheter-related urinary tract infection risk prediction model for postoperative patients with gynecological malignant tumors. The authors are grateful to all study participants

## Conflict of interests

The authors declare no conflict of interests.

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