

The Consistency Testing and Improving of A Hematuria Colorimetric Card

Wei Wang (✉ wangw2005@zju.edu.cn)

The First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, Zhejiang,

Luping Shi

College of Medicine, Quzhou College of Technology, Quzhou, Zhejiang,

Jianghui Zhang

The Fifth Affiliated Hospital of Zunyi Medical University, Zhuhai, Guangdong,

Li Ding

The First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, Zhejiang,

Yun Dai

The First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, Zhejiang,

Jie Luo

The First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, Zhejiang,

Qingwei He

The First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, Zhejiang,

Research Article

Keywords: Hematuria, hematuria colorimetric card, consistency test, blood loss

Posted Date: January 18th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-139465/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background: A Hematuria colorimetric card could unify the description of gross hematuria, but the consistency in assessing hematuria samples of a hematuria colorimetric card for gross hematuria is still inconclusive. The consistency testing and improving of hematuria colorimetric card has potential clinical application value.

Methods: According to 6 color scales (0~5), 31 hematuria samples were made. One sample was used to explain the use of hematuria colorimetric cards, and then the evaluator was asked to describe the color. After the remaining 30 samples were arranged in a random number table, 30 evaluators independently completed the hematuria sample assessment under the same conditions. Kendall W coordination coefficient was used to test inter-observer consistency. After 1 hour, 30 hematuria samples were rearranged by random digital table method, 15 of which were randomly selected from 30 evaluators, and 30 samples were evaluated independently under the same conditions. Adopt the method of Kappa to test the consistency of the two evaluation results.

Results: In the study, the evaluator lacked unity in describing the same hematuria color, including six groups of descriptive words: gross hematuria, light blood, light red, blood, scarlet, carmine. Inter-observer (inter-group) consistency test, Kendall coordination factor was 0.881($F=766.34$), $P<0.05$), the result indicates higher inter-observer agreement. For intra-observer (intra-group) consistency test, the kappa value of nurses was 0.909~1($P<0.05$), the value of doctors was 0.818~0.95($P<0.05$), and the value of students was 0.863~0.911($P<0.05$), the results showed that intra-observer agreement was also high. Consistency results between grade evaluation results of hematuria samples and standard color numbers: the average consistency of evaluation results of standard color numbers 0~5 was 100%, 100%, 94.2%, 65.2%, 38%, 65.8% respectively. The the 4th color block with low discrimination in the primary hematuria colorimetric card was eliminated, and the 5th color block was reassigned to 4th. Thus the modified hematuria colorimetric card was divided into 5 grades.

Conclusions: The improved hematuria colorimetric card has good consistency in hematuria evaluation and is an effective tool for evaluating hematuria grade, which is helpful to unify the evaluation standard of gross hematuria grade.

Background

Hematuria is one of the common symptoms and postoperative complications of urinary system diseases such as prostatic hyperplasia, kidney stones, ureteral stones, bladder cancer or urinary tract infection, etc. Assessing hematuria is an important aspect for nurses to observe the condition of the patients, it can provide evidence for doctors and nurses to decide and carry out nursing measures in time[1-2] through evaluating bleeding amount. Nowadays, most clinical nurses still estimate the color of the drainage fluid based on their subjective evaluation, but there is individual difference existing among them with big deviation, unscientific and inaccurate which may affect clinical outcomes depending on each nurse's clinical experience and skill level. In addition, some medical personnel calculate the amount of blood loss based on the red blood cell counting, hemoglobin concentration in the drainage fluid or the formula to calculate the amount of blood loss

[3-5], This way with more accurate, however, none has been widely adopted in general practice because requiring more time, more energy and increasing hospitalization costs. There are also some nursing scholars using self-made hematuria colorimetric card when assessing the degree of the hematuria, they have achieved certain success in evaluating postoperative gross hematuria, such as, using this hematuria colorimetric card can reduce anxiety levels of patients and their families and improve effective communication between doctors and nurses because they have a unified language[6]. Our team also designed and applied for a patent on a colorimetric card(ZL200420062702.8). However, different evaluators were found to have different colorimetric results for the same hematuria during clinical application, therefore, it is necessary to carry out consistency test to optimize and improve this card. Evaluate the degree of agreement regarding the assessment of various hematuria samples obtained by nurses, general practitioners, and urologists, and then according to the assessment, further optimize be needed.

Methods

Ethics statement

The study was carried out in agreement with applicable laws and regulations and good clinical practices and ethical principles. This study was approved by the Research Ethics Committee of the First Affiliated Hospital, College of Medicine, Zhejiang University. Reference Number:2018-1117.

Materials and Instruments

Disposable urinary bags, disposable 10 ml and 50ml syringes, quantitative pipette(100ul~5ml). Sysmex UF-5000 automated urinalysis analyzer, UC-3500 urine dry chemical analyzer and XN-Series automatic hematology analyzer, HD cameras (Canon, EOS M50). The specimen is required for making a hematuria colorimetric card coming from a healthy research volunteer. The urine samples left are fresh yellowish urine, tested by an automatic urine analyzer, urine analysis results should be within the biological reference range. The hemoglobin content (125 g/L) and erythrocyte count ($4.23 \times 10^{12}/L$) of the same type mixed fresh anticoagulant (A blood group selected in this study); Hemoglobin content and erythrocyte count are in the biological reference range of blood erythrocyte count in normal adult men and women in China. All subjects were informed of the use of the specimens and informed consent was obtained.

Study design

Assuming a correlation coefficient of 0.99, and α and β values of 0.05 and 0.10 for type I and II errors, respectively, the minimal sample size required to achieve the desired statistical power (0.80) was $n=5$. A total of 30 urological medical staffs were included in this study to evaluate the consistency of hematuria colorimetric card, including 10 urologists, 10 urological nurses and 10 medical students who practice in urology[7]. All people are screened by the Color Blind Examination Chart, and none of them was color blind and weak. Thirty subjects independently completed the hematuria samples assessment. Depending on their evaluation, the hematuria colorimetric card was optimized, and then the consistency test was carried out with the new hematuria colorimetric card to determine the effectiveness of the blood urine colorimetric card.

Research method

First, creating hematuria colorimetric cards. According to the materials, preparation of colorimetric card color scale, making colorimetric card master board, printing and plastic sealing colorimetric card reference to this research group patent program [9]. First, adding fresh normal urine to No.0~9 urine drainage bags, then adding fresh blood with quantitative fluid remover, the specific configuration is shown in *Table 1*. Then choosing the color scale with better discrimination to make hematuria color card, For this study, the No.0, No.2, No.3, No.5, No.7, No.8 were selected as 0~5 color clock respectively. The 0th color block is the original urine, the color of hematuria gradually deepened with increase of the color number. Blood loss per 100 ml of drainage fluid matches each color in the *Fig. 1*.

Table 1- configuration of hematuria colorimetric card

number	No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11
urine(µl)	50	49.9	49.8	49.6	49.2	48.8	48	47	46	44	42
Fresh anticoagulant blood(µl)	0	0.1	0.2	0.4	0.8	1.2	2	3	4	6	8
*blood loss (µl)	0	0.2	0.4	0.8	1.6	2.4	4	6	8	12	16

*Indicates blood loss per 100 ml of drainage fluid.

Second step was to Preparing and numbering samples to be evaluated. Continue to prepare hematuria samples for consistency test according to the above method. In this study, 31 samples of blood and urine were prepared, except for 0 color, at least 3 samples of each color number were prepared. Taking No.2 color hematuria sample for the sample which explains the usage method of hematuria colorimetric card and color of naked hematuria description as study object. The hematuria sample is prepared in a disposable drainage bag. Number 1 to 30 will be pasted on the upper left corner of the drainage bag for all other hematuria samples except the sample with "Explanation- No.2", see *Table 2*. The compilers put "Table 2 Hematuria Sample Composition" in the sealed envelope and gave it to the data statistician and data analyst. Well prepared hematuria samples are handed over to the research personnel. Compilers were not involved hematuria sample evaluation process.

Table 2 - Quantity and Numbering for Sample Preparation

Color code	0	1	2	3	4	5
Sample numbers	2	5	7	7	5	4
Sample's code	1-2	3-7	8-14	15-21	22-26	27-30

Study on the consistency of hematuria colorimetric card

Renumbering the samples, researchers hang 30 hematuria samples via sorting by random numbers, 20cm distance for each sample, and block the upper left corner of the original urine bag number, then renumbering

1~30.

Testing consistency of inter-observer assessment results. The researchers explain usage method of hematuria color card to each evaluator with "Explanation No.2", (Leave the disposable urine bag in vertical, pinching two edges in angles of the diagonal line of the drainage bag about 180 degree for shaking 2-3 times, running color contrast after mixing the fluid inside the drainage bag and colorimetric). In the same lighting environment, each evaluator independently completed the description of the color of the hematuria sample for "Explanation 2", and scored 30 hematuria samples according to 6 grades (0-5). There was no communication during the evaluation. The experiment was conducted under the supervision of a researcher. The researchers do not participate in the evaluation process and avoid communication with evaluators. After the assessment completed the researchers record and collate the results.

Intra-observer consistency test. 1 hour after the end of the intra-observer consistency test (to prevent color changes in hematuria for a long time), the researchers hang 30 blood urine samples after reordering them according to random digital, 20 cm. distance among each hematuria sample. Renumber 1~30 after sorting again with black cover paper hiding urine bag upper left corner number. Using convenient sampling method, 5 urological nurses, 5 urological doctors and 5 urological practice students are selected from the original evaluators to re-evaluate 30 cases of blood and urine samples. Each evaluator independently complete the evaluation process of 30 blood and urine samples and records the results.

Statistical analysis

The Microsoft Excel 2007, SPSS 20.0 software was used to input and analyze the data, the inter-observer consistency test adopted the Kendall W coordination coefficient, and the intra-observer consistency two times adopted the Cohen's kappa coefficient test. The measurement data are expressed by (\pm SE), and the counting data are expressed by percentage.

Results

The results about the colour obtained by the 20 examiners considered collectively were not in high agreement. There are 6 description phrases from evaluators on standard hematuria sample color description result from "Explanation No.2" prepared in the laboratory: naked hematuria, light blood, rose, blood, vermilion/scarlet and carmine. The specific statistical results are shown in *Table 3*.

Table 3 - Color Description Result

Color	naked hematuria	light blood	rose	blood	vermillion/scarlet	carmine
Doctor		10				
Nurse	1	7	1	1		
Student	1	2	2	1	2	2

Optimization of Blood Hematuria Colorimetric Card

The consistent results can be seen from *Table 4* between the evaluator's assessment results and the standard color number. The result of the 0th color and 1th were completely consistent (100%), the result of the 2th color was mostly consistent (average 94.2%, minimum 90%, maximum 100%), the result of the 3th color was moderately consistent (average 65.2%, minimum 56.7%, maximum 80%). But there was a poor consistency of the 4th color (average 38%, minimum 26.7%, maximum 43.3%. 47.4% of the 4th color was assessed as the 5th color, 23.2% of them was assessed as the 3th color). The result of the 5th color was 65.8% (average 65.8%, minimum 53.3%, maximum 90%), 33.3% of the 5th color was taken by mistake as the color 4th, it stated that discrimination between the color 4th and the color 5th was easily confused.

Table 4 - Consistency Test of Evaluation Results and Standard Color Numbers

Sample's code	Color grade	Results: Color grade (percentage)		
		Correct results	Error results	
No.1	2	200%		
No.2	1	100%		
No.3	2	2096.7%	303.3%	
No.4	5	5053.3%	4046.7%	
No.5	1	100%		
No.6	3	3070%	2030%	
No.7	1	100%		
No.8	3	3063.3%	2036.7%	
No.9	1	100%		
No.10	2	2090%	3010%	
No.11	5	5063.3%	3036.7%	
No.12	5	5056.7%	4043.3%	
No.13	0	00100%		
No.14	4	4043.4%	203.3%	5053.3%
No.15	3	3073.3%	2026.7%	
No.16	4	4036.7%	3013.3%	5050%
No.17	0	00100%		
No.18	3	3056.7%	2043.3%	
No.19	3	3056.7%	2043.3%	
No.20	4	4043.3%	5056.7%	
No.21	2	2093.3%	106.7%	
No.22	2	2093.3%	106.7%	
No.23	3	3056.7%	2043.3%	
No.24	4	4040%	3023%	5037%
No.25	3	3080%	2020%	
No.26	4	4026.7%	3033.3%	5040%
No.27	2	2096.7%	303.3%	
No.28	1	100%		

No.29	2	2093.3%	406.7%
No.30	5	5090%	4010%

The modified hematuria colorimetric card was divided into five grades (Fig.2 and Table 5), and the 4th color block with low discriminant degree in the original hematuria colorimetric card was eliminated, and the 5th color block was reassigned to 4th.

Table 5 - Final scheme and color number of hematuria colorimetric card

number	0	1	2	3	4
urine(ml)	50	49.8	49.6	49.2	46
Fresh anticoagulant blood(ml)	0	0.2	0.4	0.8	4
*blood loss(ml)	0	0.4	0.8	1.6	8

*Indicates blood loss per 100 ml of drainage fluid

Results of consistency test of hematuria colorimetric cards

Table 6 shows the results of interobserver consistency. Through the Kendall coordination factor W test, results show a high consistency (Kendall's coefficient of Concordance was 0.881, F=766.34, P<0.05) among 30 evaluators in the evaluation of hematuria using hematuria colorimetric card). Kendall coordination coefficient W test result based on evaluators' occupation shows: nurses are the top 1 with 0.901, F=261.17, P<0.05, there is significant consistency between nurses; doctors follow nurses as the second with 0.899, F=260.70, P<0.05, there is significant consistency between doctors; the last one is the practice students with 0.884, F=256.25, P<0.05, there is significant consistency between students also.

Table 6 - Interobserver consistency

	Kendall's coefficient of Concordance	F	P
Total	0.881	766.34	<0.001
Nurse	0.901	261.17	<0.001
Doctor	0.899	260.70	<0.001
Student	0.884	256.25	<0.001

The results of intra-observer consistency. Through the Kappa test, Results show a high consistency (average kappa= 0.991, P<0.05) among 15 evaluators in the evaluation of hematuria using hematuria colorimetric card). Kappa test results (show in Table 7) based on evaluators' occupation show: The Kappa value range of 5 nurses was 0.909~1, (Average Kappa=0.945, P<0.05). Doctors follow nurses as the second, the Kappa

value range of 5 doctors was 0.818~0.95(Average Kappa=0.898, P<0.05). The last one is the practice students with 0.863~0.911Average Kappa=0.891P<0.05.

Table 7 - Intraobserver consistency test

	The value of Kappa	P
Total	0.911	<0.001
Nurse	0.909~1	<0.001
Doctor	0.818~0.95	<0.001
Student	0.863~0.911	<0.001

Discussion

It is essential to unify the description about the color of the gross hematuria among medical staffs

The results showed that the clinical importance of hematuria colorimetric card was 4.80 ± 0.41 , including 4.80 ± 0.42 for nurses, 4.60 ± 0.52 for doctors and 5 for medical students. So, evaluators believe that hematuria colorimetric card is very important in clinical application, and medical personnel recognize that unified evaluation standard is important for clinical work although medical personnel still lack a unified evaluation standard of naked hematuria color grade [8-9]. For doctors, unifying the color standard of hematuria not only enable doctors to observe the process of patient's condition accurately and dynamically with different working years, but also benefit the effective information exchange between doctors and nurses, doctors and patients as well. For nurses, unifying the color standard of hematuria not only standardize urological hematuria observation and recording specification, but also help nurses to carry out accurate nursing practice and research[10-11]. Therefore, it is very important to unify the color description of hematuria with naked eye to ensure the accurate communication of the medical team and the safety of hematuria patients.

Hematuria colorimetric card provides a standard for medical staff to objectively evaluate the color of hematuria

The results show that nurses had a good consistency in the description of hematuria color, while doctors had poor consistency in the description of hematuria, and the description of hematuria in medical students were obviously lack of unity. This may be because medical students were still in the learning stage, the internship period of each department was mostly one month, so the unity of the description of clinical phenomenon was still lacking. Nurses are the most frequent clinical contact with patients, but also the link between doctors and patients, so nurses had a more better unified view of clinical phenomenon in order to communicate with doctors and patients better. Lack of uniformity in the description of hematuria may lead to obstacles during handovering on patients' conditions and in communication between medical teams. Hematuria is one of the important bases for clinical urology to judge postoperative blood loss[12]. Because, bad communication will not only cause medical errors, but also lead to medical incident[13], so there should be a unified descriptive language for communication and exchange between medical teams. The use of the

hematuria colorimetric card standardized and provided a scientific basis for color evaluation , which facilitated communication between physicians, nurses, and patients, thereby improving patient satisfaction[14]. The results of this study show that this hematuria colorimetric card can well unify the description of hematuria among medical staff.

Guidance of the hematuria colorimetric card on clinical work and research

The optimized hematuria colorimetric card is easy to make and carry, The card is convenient for patients and medical personnel to be kept in their pockets. Thus it will be facilitate widespread use. The card can also be designed as paste type which fixed to the drainage bag, and can also store the electronic version of the colorimetric card in the mobile device. This card is convenient for nurses , patients and doctors to check the color of hematuria, it has certain guiding effect on clinical work. First, nurses can use this haematuria colorimetric card to introduce the relationship between the color of drainage fluid and the amount of bleeding to the patients and their families before operation. This card can help patients and their families view hematuria correctly after surgery, which can relieve or elimination the nervous fear of patients and family members. On the other hand, bladder irrigation is often carried out to reduce postoperative complications in patients with hematuria after urology [15-16], but too fast irrigation will increase intravesical pressure, and high velocity will cause certain stimulation to the bladder wall. Enhancing parasympathetic excitability is a very important risk factor for bladder spasm [17]. As a result, the correct and reasonable adjustment of washing speed can improve nursing quality and bring relatively comfortable experience to patients [18]. With this hematuria colorimetric card, nurses can decide whether to carry out bladder irrigation and the speed of bladder irrigation according to the depth of hematuria color in the patient's drainage bag. Bladder irrigation should be carried out when the color number is 2 or above. The washing speed can be adjusted to 80~120 drops per minute. When the hematuria color is 3 or above, the washing speed should be accelerated, and the recommended speed should be adjusted to 160 drops per minute or more, the rate of irrigation is based on our experience in clinical. In addition, hematuria colorimetric card designed in this study marked the color number and corresponding blood loss (converted to blood content per 100 ml of drainage fluid). Nurses can directly judge the postoperative blood loss. For example, the total amount of bladder drainage fluid was 1000 ml within 2 hours after urological operation, the drainage fluid matches the No.3 colour, the blood concentration corresponding to the No.3 is 1.6%, the estimated blood loss was $1.6\% \times 1000 \text{ ml} \approx 16 \text{ ml}$. Based on the total blood loss assessed by the nurses, the lost hemoglobin content can also be further calculated. The formula is: the lost hemoglobin = the hemoglobin concentration \times the total blood loss.

Because the haematuria card marks the amount of blood loss for each color, nurses can conduct a multi-center, large sample study based on this haematuria colorimetric card about the changes of postoperative bleeding in different urinary diseases[19]. Besides, by using this haematuria colorimetric card, the color of drainage fluid, the amount of drainage fluid and the amount of bleeding were plotted on the urine color observation table after urological operation. Medical staff can see the data curve intuitively, it is convenient for medical personnel to understand the patient's condition in time, and it is beneficial to nurses to carry out fine nursing.

Conclusions

This study carried on the consistency test and the improvement to the hematuria colorimetric card, provided a convenient, efficient and unified hematuria evaluation tool for the medical personnel, received the unanimous affirmation of the clinical medical personnel, and had certain guiding significance to the clinical work. However, there are still some shortcomings. To evaluate the color of the hematuria is still depends on the eyes of the medical staff, and it is inevitable that there will be a certain subjective judgment. Furthermore, for limited by light and photography technology, color is not completely accurate. Nowadays, with the rapid development of information technology and digital technology, the accuracy and convenience of the hematuria colorimetric card can be improved, which expected further research in subsequent experimental studies.

Declarations

Ethics approval and consent to participate

The study was carried out in agreement with applicable laws and regulations and good clinical practices and ethical principles. This study has obtained the informed consent of all subjects. This study was approved by the Research Ethics Committee of the First Affiliated Hospital, College of Medicine, Zhejiang University
Reference Number:2018-1117.

Consent for publication

All authors of the study agree to publish the article.

Availability of data and materials

The dataset supporting the conclusions of this review is included within the identified reports

Competing interests

The authors declare that they have no competing interests.

Funding

This work was supported by the Zhejiang Medical and Health Science and Technology Project [2018ZD006], the Basic Public Welfare Research Scheme of Zhejiang Province [LGF19H050007], Zhejiang Medical and Health Science and Technology Project[2020KY111].School-Enterprise Cooperative Development Project of University Visiting Engineer of Zhejiang Education Department (FG2020209). The funder had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Authors' contributions

Conceived and designed the experiments: Wei Wang and Luping Shi. Analyzed the data: Luping Shi, Jianghui Zhang and Li Ding. Contributed reagents/materials/analysis Yun Dai, Jie Luo, Qingwei He and Jianghui Zhang. Wrote or revised the manuscript: Wei Wang and Luping Shi. All authors have read and approved of the final manuscript.

Acknowledgements

None.

Authors' information (optional)

None.

References

1. Vedula R, Iyengar AA: **Approach to Diagnosis and Management of Hematuria.** *Indian J Pediatr.* 2020 , 87(8):618-624.
2. Kocaçal E, Karadağ E: **Nursing diagnoses and NIC interventions in adult males undergoing radical prostatectomy.** *Rev Esc Enferm USP* 2020, 54: e03541
3. Desmond J: **A method of measuring blood loss during transurethral prostatic surgery.** *J Urol* 1973, 109:453-456
4. Ren J, Lai S, Jiang Z, Xu X, Diao T: **A Systematic Review and meta-Analysis of the Effects on Dutasteride Treatment for Reducing Surgical Blood Loss during Transurethral Resection of the Prostate.** *Urol Int* 2017; 98:456 -465
5. Jaramillo S, Montane-Muntane M, Capitan D, Aguilar F, Vilaseca A, Blasi A, Navarro-Ripoll R. **Agreement of surgical blood loss estimation methods.** 2019, 59:508-515.
6. Georgieva MV, Wheeler SB, Erim D, Smith-Bindman R, Loo R, Ng C, Garg T, Raynor M, Nielsen ME: **Comparison of the Harms, Advantages, and Costs Associated With Alternative Guidelines for the Evaluation of Hematuria.** *JAMA Intern Med.* 2019 , 179:1352–62.
7. Ng K, Asunta P, Leppä N, Rintala P: **Intra-Rater Test-Retest Reliability of a Modified Child Functioning Module, Self-Report Version.***Int J Environ Res Public Health.* 2020, 17(19):6958.
8. Ghandour R, Freifeld Y, Singla N, Lotan Y: **Evaluation of Hematuria in a Large Public Health Care System.***Bladder Cancer.* 2019; 5:119-129.
9. Ark JT, Alvarez JR, Koyama T, Bassett JC, Blot WJ, Mumma MT, Resnick MJ, You C, Penson DF, Barocas DA: **Variation in the Diagnostic Evaluation among Persons with Hematuria: Influence of Gender, Race and Risk Factors for Bladder Cancer.***J Urol.* 2017, 198:1033-1038.
10. Prasad B, Jafari M, Kour K, Goyal K, Garcia F. **Feasibility Study of a Randomized Controlled Trial Investigating Renal Denervation as a Possible Treatment Option in Patients With Loin Pain Hematuria Syndrome.***Can J Kidney Health Dis.* 2020, 7:2054358120951390.
11. Schaake W, van der Schaaf A, van Dijk L V: **Development of a prediction model for late urinary incontinence, hematuria, pain and voiding frequency among irradiated prostate cancer patients.** *PLOS ONE* 2018,13: e197757
12. Lee J Y, Chang J S, Koo K C: **Hematuria grading scale: a new tool for gross hematuria.** *Urology* 2013, 82: 284-9
13. Wei Wang, Xichao Guo, Qingwei He: **Hematuria colorimetric card [P].** *CHINA* CN103575665A, 2014-02-12

14. Bolenz C, Schröppel B, Eisenhardt A: **The Investigation of Hematuria.***Dtsch Arztebl Int.* 2018, 115:801-807.
15. Guo RQ, Yu W, Meng YS: **A nomogram predicting re-operation due to secondary hemorrhage after monopolar transurethral resection of prostate.** *Kaohsiung J Med Sci* 2018, 34:172-8
16. Zhou Z, Zhao S, Lu Y: **Meta-analysis of efficacy and safety of continuous saline bladder irrigation compared with intravesical chemotherapy after transurethral resection of bladder tumors.***World J Urol.* 2019, 37: 1075-
17. Ma ZZ, Han YX, Wang WZ: **The use of a homemade rate adjustment card in patients with continuous bladder irrigation after transurethral resection of the prostate.** *Transl Androl Urol.* 2020, 9(5):2227-2234.
18. Zhou Zhongbao, Zhao Shikai, Lu Youyi: **Meta-analysis of efficacy and safety of continuous saline bladder irrigation compared with intravesical chemotherapy after transurethral resection of bladder tumors.** *World journal of urology* 2019, 37:1075-1084
19. Romero-Otero J, García-González L, García-Gómez B, Justo-Quintas J, García-Rojo E, González-Padilla DA, Sopeña-Sutil R, Duarte-Ojeda JM, Rodríguez-Antolín A: **Factors Influencing Intraoperative Blood Loss in Patients Undergoing Holmium Laser Enucleation of the Prostate (HoLEP) for Benign Prostatic Hyperplasia: A Large Multicenter Analysis.** 2019,132:177-182.

Figures

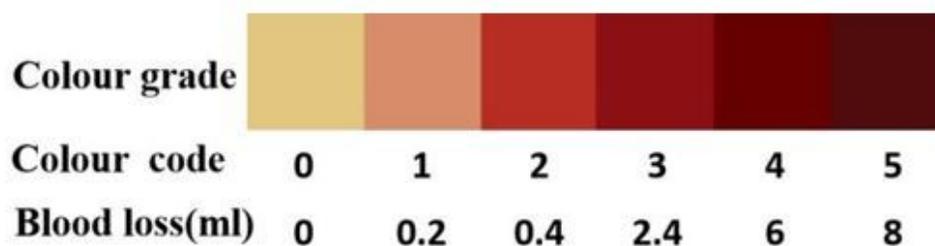


Figure 1

hematuria colorimetric card

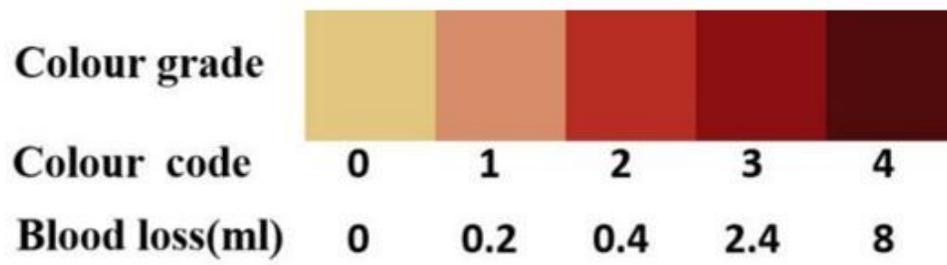


Figure 2

Improved hematuria colorimetric card