Comparison of ATP fluorescence test and protein residue test for cleaning monitoring effect

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[Abstract] Objective: To explore the cleaning monitoring methods which are currently widely used，we compare ATP fluorescence test and quantitative protein residue test to find which method is more accurate for monitoring of cleaning quality. **Method:** A mixture of Escherichia coli and serum was uniformly lay out on 150 vascular forceps for 8 hours. After the soils on the surface of the instruments were completely dried, the instruments were then cleaned and disinfected by the same way. After that, the cleaning quality of these instruments were inspected by ATP fluorescence test and quantitative protein residue test respectively. **Results:** Using ATP fluorescence test, the number of qualified instruments was 139, while the number of unqualified instruments was 11, and the pass rate was 93%. Using quantitative protein residue test, the number of qualified instruments was 124, while the number of unqualified instruments was 26, and the pass rate was 83%. There was a statistically significant difference between the two methods (X^2=6.04, P<0.05). **Conclusion:** After experimental comparison and biological culture verification, it was found that both of the two test methods can be used for routine cleaning quality testing. Each of the two methods cannot contain the other, and it is best to use the two methods together.
[key words] ATP fluorescence test; quantitative protein residue test; cleaning effect monitoring

Whether the instruments are qualified cleaned determines the success of sterilization. High-quality and qualified cleaning is the premise to prevent and control infection in hospitals, also can ensure the success of sterilization . If the surface of the instruments is not thoroughly cleaned, a large amount of organic matter may aggregate to form biofilms. Biofilms on the surface of device can prevent the entry of sterilization factors during sterilization, which will ultimately lead to the failure of sterilization, which may cause nosocomial infections. WS310.3-2016 "Central sterile supply department (CSSD) Part 3: Surveillance standard for cleaning, disinfection and sterilization " proposes that it is necessary to test the quality of cleaning daily and periodically. The main purpose of this paper is to explore the ATP fluorescence test and quantitative protein residue test which are commonly used in current routine tests, and to compare the significance of the two test methods for the evaluation of cleaning effect.

1 Materials and methods

1.1 Materials ATP surface sampling rod, quantitative protein residue test rod, quantitative protein culture reader, E. coli (live bacteria), serum, 150 vascular forceps.

1.2 Method A mixture of Escherichia coli and serum was uniformly lay out on 150 vascular forceps for 8 hours. After the soils on the surface of the instruments were completely dried, the instruments were then cleaned and disinfected by the same way. After that, the cleaning quality of these instruments will be inspected by ATP fluorescence test and quantitative protein residue test respectively. Microbial culture will be performed on unqualified instruments.

1.2.1 ATP Fluorescence Test Use the sampling rods to sample at the two outer sides, the joints, the rear buckles, and the anterior teeth of the vascular forceps. The snaps and teeth are sampled along the lines. After sampling, insert the sampling rod into the test tube, shake it back and forth 8 times gently, and put it into the device test hole to read and record the value. The measured value RLU is set under standard recommended by the Chinese CDC and the US CDC. RLU≤150 is qualified, RLU≤100 is excellent, and the value >150 is positive.

1.2.2 Quantitative protein residue test Take out the sampling rod from the protein test rod, follow the manufacturer's instructions, drop 1-3 drops of dampening solution onto the swab, and sample on both sides, joint, rear buckle, anterior teeth of the vascular forceps. The teeth, snaps and tooth are sampled along the grain path. After sampling, insert the sampling rod into the test rod, activate the reaction solution, shake it back and forth 5 times. Then put it into the quantitative protein culture reader, the culture temperature is 60 ° C, the culture time is 10 min, and then obtain the result through the built-in printing device of the reader. The residual protein will be recorded with specific values. The interpretation criteria for the measured values refer to the (AAMI TIR30:2011) standard of the American Medical Device Promotion Association. In the standard of AAMI TIR30:2011, Professor Alfa set the qualified boundary value of protein residue in the worst case for duodenoscopy to 1 μg/cm^2 . Record the results.

1.3 Statistical analysis Data were analyzed by SPSS19.0. The count data were expressed as the rate (%). The X^2 test was used, P<0.05 was considered statistically significant.

2 Results

Among the 150 samples, the number of ATP-tested qualified items was 139, the number of unqualified items was 11 and the pass rate was 93%; the number of qualified protein test qualified items was 124, and the number of unqualified products was 26, and the pass rate was 83%. There were 119 qualified items in both ATP test and quantitative protein residue test, and 6 were unqualified, while there were 20 items qualified in ATP test, yet unqualified in quantitative protein residue test. 5 items were qualified in quantitative protein residue test while unqualified in ATP test. There was statistical significance between the two methods (X^2=6.04, P<0.05), as shown in Table 1.

Table 1 Test results of ATP test and quantitative protein residue test

		quantitative protein test		X^2	P value
		qualified	unqualified		
ATP test	qualified	119	20	6.04	0.014
	unqualified	5	6		

3 Discussion

According to the 4.1.2.3 regulations of China's "WS 310.3-2016" standard, quantitative monitoring methods can be used regularly to evaluate the cleaning quality of instruments. To control nosocomial infections, thoroughly cleaning of instruments is crucial. Contamination will form biofilms, affect the quality of disinfection, and cause the failure of sterilization. Residual soils can also cause corrosion, erosion and damage of the instruments, which eventually make the service life of the instruments short. It is very important to evaluate and monitor the cleaning quality of medical instruments objectively.

As a commonly used cleaning quality monitoring method, ATP fluorescence test is simple, rapid, and can test various kinds of organic substances ; in the past, quantitative protein residue test is semi-quantitative. Though it is highly sensitive and can directly reflect cleaning quality, it takes a long time . There are test rods and special culture readers that can accurately quantify protein residue, and the culture time is only 10 minutes; The corresponding residual components on the device can be quantitatively detected, and the quantitative protein residue test method and the ATP fluorescence test method are complementary.

After experimental comparison and biological culture verification, it was found that both of the two test methods can be used for routine cleaning quality testing. Each of the two methods cannot contain the other one. Use the two methods together will be more comprehensive and can further ensure the scientificness of the cleaning quality monitoring method and the accuracy of the results.