

Improving staff safety with checklists during novel coronavirus disease (COVID-19) pandemic

A quasi-experiment study in vascular surgical department

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Abstract

Novel coronavirus disease (COVID-19) emerged in Wuhan in December 2019, has spread in many countries affected people globally. In response to the economic requirement of the nation and meet the need of patient's, a momentous event was going back to work step by step as fighting against COVID-19. Safety in clinical work is of priority as elective surgery in the department of surgery progressing. We used checklists based on our experiences on COVID-19 control and reality of clinical work from February to March in the West China Hospital, involving events of screening patient, chaperonage, and healthcare workers. Checklist summarized the actual clinical nursing work and management practices, hope to provide a reference for the order of surgery during the epidemic prevention and control, and standardize the clinical nursing work of surgery during pandemic.

Abbreviations: COVID-19 = novel coronavirus disease, CRAs = chlorine-releasing agents, RT-PCR = reverse transcription-polymerase chain reaction.

Keywords: checklists, novel coronavirus disease, staff safety

1. Introduction

Novel coronavirus disease (COVID-19) due to the severe acute respiratory syndrome corona virus 2 (SARS-CoV2) that causes a cluster of acute respiratory illness has affected people worldwide.^[1] Studies before indicated that the endothelium, one of the largest organs in the human body, was a target organ in COVID-19.^[2] As of April 16, 2020, globally there were 1991,562 confirmed cases of COVID-19, and 130,885 deaths. The rapidly evolving of COVID-19 epidemic and the increasing reported number of confirmed cases and deaths had resulted in a World Health Organization (WHO) officially declared pandemic on March 11. The pandemic impacted the psychology and social economy in an unprecedented manner, with social distance and

travel restrictions, closures of schools and many businesses, and fear of shortages of basic living needs.

While preventing the virus, hospitals were also responsible for the provision of health care which had the potential to expose medical staffs to COVID-19. As time went by, hospital admission rate and surgical amount in vascular surgery department increased gradually. The growth of workload and the flow of people made not only healthcare environment more sophisticated^[3] but also the risk of cross infection between medical staffs and patients higher. In this setting, safety was a comparatively inevitable topic, strict and effective infection control protocols are urgently needed.

One positive tool for the improvements in patient safety was “surgical safety checklists,” which had been proposed by the World Health Organization (WHO), and wildly used to improve care processes and patient safety.^[4] Several studies had shown the positive effect of checklists in clinic, including effectiveness in decreasing central line-related infections, reducing treatment errors, and improved communication in ICUs.^[5–8] Nowadays, the safety checklists originally designed by the WHO has been adapted to the specific needs worldwide. So checklists could also standardize clinic tasks and help healthcare workers adopt good behaviors in a high-stress scenario during COVID-19 pandemic.

In order to protect the safety of patients and staffs, and maintain the normal order of hospital, we provided a try for the design, context, and structure of checklists adapted for healthcare workers and vascular surgery department when operating prevention and control work. The transfer of expert knowledge and best evidence to the healthcare workers in vascular surgery department via a checklist intervention may help to improve quality of care and procedural performance. The high risk of procedures and operations in clinic during pandemic and the low cost of a checklist intervention made this a promising target. The results may provide basis for further prevention and control of COVID-19 in vascular surgery department.

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All data generated or analyzed during this study are included in this published article [and its supplementary information files].

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Table 1
Verify that new patients were screened and complied with criteria.

Categories	Items	Do and confirm	
		Yes	No
Epidemiologic	Traveled to Wuhan or a place where COVID-19 is spreading in the past 14 days. Have a close contact with people from Wuhan or other areas with ongoing transmission of COVID-19 and with symptoms in the past 14 days.		
Symptoms	Fever Cough, short of breath, persistent pain or pressure in the chest, confusion		
Tests	Tested positive for COVID-19 by throat swab Tested positive for COVID-19 by RT-PCR Chest CT		

Responsible party: nurse and doctors. Screening checklist for new patients. CT=computed tomography, RT-PCR=reverse transcription-polymerase chain reaction.

2. Materials and methods

2.1. Checklists

We obtained the required approval from the west China hospital. Checklists were designed based on National Health Commission of the People’s Republic of China and our institutional policies and we aimed to design an easy-to-use tool that requires little time but provides order, logic, and systematization and increase the level of both workers and patient safety in vascular surgery department during COVID-19 pandemic. The checklists should be as short as possible, easy to administer, yet be detailed enough so critical items were not omitted. As a one-page paper checklist, this tool needed to be completed by operators before leaving hospital every day to remind staffs standard procedures.

The checklists included evaluation and management of new patients and inpatients, key steps in protective equipment wearing before contacting patients, the right times for hand hygiene, and the ways to disinfect the surface and object in wards and working areas. (Tables 1–4).

While many patients with confirmed COVID-19 infection developed fever and/or signs of respiratory illness such as cough and shortness of breath, most patients were either asymptomatic or only mildly ill. Special attention was paid to screening the new patients because asymptomatic patients were capable of

spreading infection. Wearing facemasks was especially important for all the people in hospital for the virus were most commonly spread via respiratory route which required close person to person contact (within 6 ft.). Keeping social distance from others, avoiding crowds and group events, and staying 6 ft. away from other people, was equally important. Transmission of virus may occur if a person touched a surface or object that has the virus on it and then touched their own mouth, nose, or possibly their eyes. SARS-CoV-2 may remain viable in aerosols for up to 3 hours and up to 72 hours on plastic,^[9] but can be effectively inactivated from surfaces with a solution of either ethanol (62–71% alcohol), hydrogen peroxide (0.5% hydrogen peroxide), or sodium hypochlorite (0.1% bleach) in just 1 minute. Hence, strict compliance to infection control and hand hygiene was important, handwashing with soap or alcohol-based (minimum 60%) hand sanitizer for at least 20 seconds was the most effective way to minimize exposure. Meanwhile, touched objects and surfaces have to be thoroughly wiped-down after used with appropriate disinfectants.

2.2. Assessment

An assessment of hand hygiene compliance was conducted for a week prior to the introduction of the checklists. The checklists

Table 2
Verify oneself well-equipped.

Categories	Items	Do and confirm	
		Yes	No
Self-check	Have a fever Have a shortness of breath, cough, or other symptoms Have the results reported		
Personal protective equipment	Wear surgical mask and change every 4 hours Wear cap and gloves Wear face-shield, fluid-resistant gown, eye-protection when necessary Change units everyday		
Shift-change	Take full advantage of buffer zone Less than 30 minutes Less than 3 staffs		
Hand hygiene in and out of hospital	Through route for workers Use private elevator for workers		
Other precautionary behaviors	Keep distance (>1 m) with others The number of participants limited to 2 every physician–patient communication Bring meals or eat in the canteen of hospital		

Frequency: daily. Responsible party: nurse and doctors. Checklist of self-protection for doctors and nurses.

Table 3**Verify that all the inpatients and chaperonage informed and adopted good behaviors.**

Categories	Items	Do and confirm	
		Yes	No
Preventive measures	Monitor temperature fourth a day		
	Wear masks		
	Change masks		
	Clean hands		
Care givers	Cough and sneeze etiquette		
	≤1		
	Personnel with duties at >1 patient restricted to 1 patient		
Diets	Decline any visiting		
	Supplied by hospital		
	Avoid crows and queue when food delivered		
Others	Avoid talking when having meals		
	Limit the number of luggage		
	Call healthcare workers immediately if you have symptoms such as fever, cough, or difficulty breathing		
	Sign an informed consent form related to COVID-19 pandemic		
	Enter and exit hospital through routes for non-staff		

Frequency: daily. Responsible party: nurse. Education checklist for inpatients and chaperonage.

were then introduced to staffs through formal teaching sessions and 2 repeat assessments were conducted 4 weeks apart. A nurse, acted as the assessor, assigned to collect data on 30 opportunities for hand hygiene of all workers.

2.3. Analysis

Statistical analysis was conducted using SPSS Inc. (Chicago, IL, USA) for Windows version 19. Compliance was analyzed using chi-squared test. Statistical significance was deemed when the 2-tailed *P*-value was <.05.

3. Results

During the study period, 840 hand hygiene opportunities were identified. Overall hand hygiene compliance increased from week 1 (72.4%) to week 4 (91.0%) (*P* < .01 based on chi-squared test) (Fig. 1).

4. Discussion

The outbreak of COVID-19 made clinic work more complicated and increased emotionally and physically strain of healthcare

workers. The human factors literature demonstrated conclusively that cognitive functions such as memory and arithmetic calculation were vulnerable to error or even complete failure, especially during periods of stress or time pressure. For both inexperienced workers and specialists may make mistakes, safety for both patients and workers were threatened, and attracted more and more attention of hospital. Because of the complexity of health care processes, checklists were introduced and offload memory and safeguard the correct recall of critical items, ensure that critical steps were not missed and also helped ensure the use of current best practices.

With the ability for prevention and foreseeability of errors in medical servers, checklists had been widely used in healthcare system to ensure that important steps in a process were not forgotten and improve safety in clinic. Levels of worker performance were seen to deteriorate during periods of high workload. “Do and confirm” can be useful both for information that relied on perception and for determining which actions were or were not completed. Checklists were positive for the healthcare workers by creating a shared set of standards and goals and improving compliance in precautionary behaviors. In this way, checklists could be useful in increasing effectiveness in self-protection, thus minimizing risk. And the daily goals checklists

Table 4**Verify the environment of department tidy and clean.**

Categories	Items	Do and confirm	
		Yes	No
Inpatients wards	Limit the number of patients to 3 every room and keep distance (≥3m)		
	Disinfect air 3 times a day and last for 30 minutes		
Duty rooms	Wipe-down the floor and surface of furniture after disinfection with CRAs twice a day		
	Disinfect air or ventilate for 30 minutes twice a day		
	Wipe-down the floor and surface of furniture with CRAs everyday		
Doors	Full-time manager		
	Keep closed		
	Check access control system and keep it working		
	Screening people entering and exiting hospital		
	Register people entering and exiting hospital		

Frequency: daily. Responsible party: care workers. Checklist for management of environment. CRAs = chlorine-releasing agents.

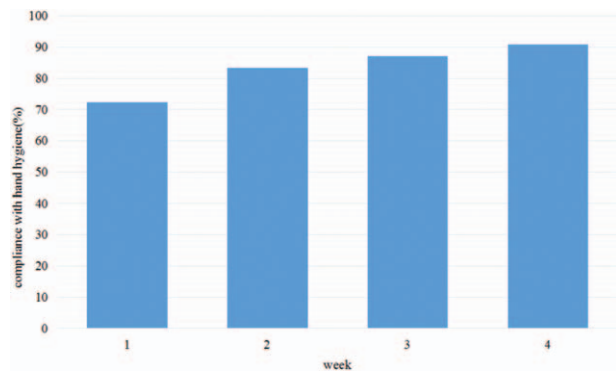


Figure 1. Overall hand hygiene compliance during the 4 weeks.

helped to identify new protection issues and sparked management discussions.

One known example of a cognitive aid was the use of checklists, which aimed to implement evidence-based and best-practice strategies routinely and universally. During a crisis such as COVID-19 pandemic, people sometimes reverted to what they originally learned, not what was the latest recommendation. Checklists made knowledge explicit and applicable in the particular situation in clinic rather than only being in people's mind.

Checklists can also improve the confidence of nurses and surgeons.^[10] Human memory of actions delegated and performed is vulnerable, especially when great pressure existed. Checklists had a notable impact on the mental preparation of the workers for the upcoming operations and the use of which were relatively easy and good to prevent missing steps that can be critically. With the checklists, workers seemed to think more about possible risks associated with the virus.

Of importance, checklists were not 100% effective and a checklist worked only when used correctly and need to be implemented with appropriate engagement and leadership to ensure adherence and usability. There were also examples in the literature of disappointing results.^[11] Relying on memory while using a checklist may resulted in failure,^[12] some healthcare workers recollected the sequence of steps with a conscious cognitive memory which could become increasingly difficult in a stressful situation. Researches from 2009 to 2016 showed the complexity of standardizing, implementing, and sustaining the using of checklists.^[13] Checklists must be monitored and adapted for utility to the specific environment, culture of the institution, and timing of when the checklists were actually used prior to implementation. Operators required proper training before widespread implementation of a checklist and becoming familiar with the layout and purpose of the checklists can helped staffs use them effectively.

5. Conclusion

Checklists can have impact but were not the single solution to many safety problems in clinic. Regardless of the specific steps, such a checklist that verifies the presence of key safety items was helpful for safe delivery of healthcare during COVID-19 pandemic.

Author contributions

Data curation: Lin Zhang, Xiaoyan Liu, Jing Huang.

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