

Application of new Alexandria quality checklist in intensive care units in Alexandria main University hospital and its effect on patients outcome

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ABSTRACT

Quality checklist is a newly designed checklist used to improve quality of medical care in intensive care unit through following certain rules and regulations. In the present study, this checklist was applied daily during clinical rounds in intensive care unit three (ICU3) in Alexandria Main University Hospital for three months for all patient admitted to ICU3. The results of this group were compared to retrospective results from previous three months before application of the checklist. The study showed no significant difference in baseline assessment data, while showed significant improvement in mortality rates, decrease in rates of ventilator associated pneumonia and central venous line infection and head of bed elevation. Moreover, no significant difference was founded in urinary tract infection related to urinary catheter insertion. From this study it was concluded that the use of quality checklist in daily (ICU) clinical rounds may improve both mortality rates and morbidity. So, it was recommended that the application of this checklist should be on wide scale in all intensive care units.

Keywords: checklist, ICU, quality, Alexandria

INTRODUCTION

A checklist defined as an organized tool that outlines criteria of consideration for a particular process. It functions as an aid resource to delineate and categorize items as a formation that makes conceptualization and

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recall of information easier. In both medical and non-medical fields checklists are widely used as cognitive aids to show users who complete tasks accurately.⁽¹⁾

In specific fields of medicine, a fast systemic approach to crisis management is required such as Critical care and Emergency medicine, thus the usage

of specific types of checklists and memory-aids shown to be helpful and may save life.^(2,3) to improve medical care quality that is given to the patients.⁽⁴⁾ many examples of used checklists nowadays such as checklist of the prediction of successful weaning from mechanical ventilation in (intensive care units) ICU patients,⁽⁵⁾ adherence to evidence-based best practices,⁽⁶⁾ and patient safety improvement in variable medical fields.⁽⁷⁻¹⁰⁾

High rates of adherence to the guidelines (4) decreased rates of central line associated blood stream (infection in Intensive care units showed to be one of the benefits of applying checklists.^(12,13)

Although checklists have noticeable value in improving safety, quality, and having economic importance by reducing costs of medical care in general, they are underused as in medicine, high resistance from physicians are noticed because some of them feel that checklist are insulting their intelligence, and sometimes they doubt the effectiveness of this simple paper in improving the quality of health care they provide and can reduces errors that may be done.⁽¹⁴⁾

The science to develop a checklist in health care is new. There is not any established standardized methodology to develop and design checklists in medicine, and all researches recommended to develop further areas of research in the formation of checklists focusing on the evaluation of checklist in medicine fields, the impact of to apply checklist from the patient view, continuous evaluation of outcome improvements and strict tracking of error rates for the respective checklist focus.⁽¹⁵⁾

However, the evidence which supports applying of checklists in critical care medicine fields which derived from before-after studies, all were set in high-income countries. Evidence from randomized trials is lacking in growing countries like Egypt.⁽¹⁶⁾

This study aimed to evaluate the clinical impact of applying a newly designed quality checklist for improving outcomes of patients admitted to intensive care unit number three (ICU3) in Alexandria Main University Hospital.

MATERIALS AND METHODS

The study was carried out on patients who admitted to (ICU3) in Alexandria Main University Hospital. This study included baseline assessment for mortality rates and major complications during two periods, retrospective study before application of quality checklist (from July 2016 to September 2016) and Prospective one where new quality checklist was applied during clinical round for another three months (from October 2016 to December 2016). Mortality rates and major complications were recorded to be compared during the two periods.

The major complications in the form of ventilator-associated pneumonia (VAP), central venous catheter (CVC) infection, and urinary catheter associated urinary tract infection), DVT prophylaxis, head of bed elevation, and drug errors, from all patient admitted to ICU3 in the previous three months before the beginning of the study.

RESULTS

The present study was performed over six months' period, three months retrospective and three months prospective after application of checklist. A total of two hundred sixty-four patients were included in the study, one hundred thirty-eight in retrospective studies whereas in prospective study they were one hundred twenty-six.

It was found that no significance difference as regard age in two periods as P:0.396. (Table-1) As regard sex in the present study, one hundred forty-twos were males, and one hundred twenty-twos were females. In retrospective study (55.8%) was males while (44.2%) was females. On the other hand, in prospective study (51.6%) was males while (48.4%) was females (Figure-1). The present study was performed over six months'

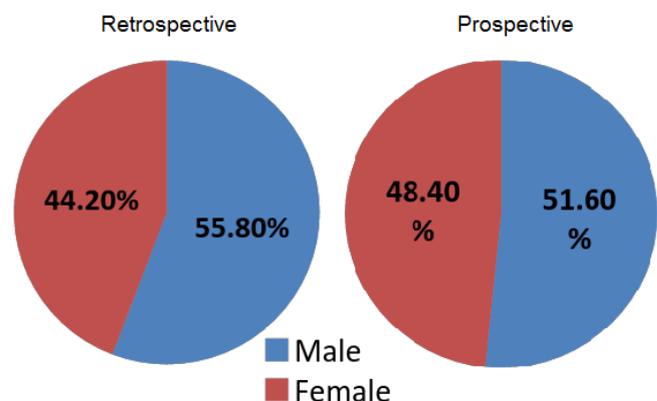
period, three months retrospective and three months prospective after application of checklist.

A total of two hundred and sixty-four patients were included in the study, one hundred thirty-eight in retrospective studies whereas in prospective study they were one hundred twenty-six. This study showed no significant difference in baseline characteristics between the two groups pre and post checklist applying (Table-1). It was found that no significant difference regarding age as P=0.396, as regard sex in the present study, one hundred forty-twos were males, and one hundred twenty-twos were females. In the retrospective phase 55.8% were males and 44,2% were females. On the other hand, in prospective phase there were 51.6% males and 48.4% were females.

Table-1. Total number and age related retrospective and prospective group

| Parameter | Retrospective group (n=138) | | Prospective group (n=126) | | p |
|-------------|-----------------------------|-------------|---------------------------|-------------|--------------|
| | Median | (Min - Max) | Median | (Min - Max) | |
| Age (years) | 30 | (1 - 90) | 32 | (1-88) | 0.396 |

Figure-1. Sex distribution between prospective and retrospective studies



According to the type of admission, there was no significant difference between two studied groups.

Table-2. Comparison between the two studied groups according to Type of admission.

| Type of ICU admission | Retrospective (n=138) | | Prospective (n=128) | | P |
|-----------------------|-----------------------|---------|---------------------|---------|--------------|
| | No. | % | No. | % | |
| Trauma | 28 | (20.3%) | 28 | (22.2%) | 0.701 |
| Postoperative | 8 | (5.8%) | 7 | (5.6%) | 0.933 |
| Medical reasons | 74 | (53.6%) | 64 | (50.8%) | 0.646 |
| Poisoning | 28 | (20.3%) | 27 | (21.4%) | 0.820 |

In the retrospective group there were twenty-eight patients admitted due to trauma, eight patients due to postoperative causes, seventy-four due to medical reasons and, while twenty-eight patients due to poisoning (Table-2). On other hand in the prospective group there were twenty-eight patients admitted due to trauma, seven patients due to postoperative causes, sixty-four due to medical reasons, while twenty-seven patients due to poisoning (Table-2).

As regard the cause of ICU admission the highest percentage in prospective study were 47% and 41.3% that represented DLC and respiratory failure respectively while in retrospective study they were 46.45% and 36.2% for the same parameters with no statistical differences between both groups (Table-3).

Table-3. Comparison between the two studied groups according to cause of admission

| Parameter | Retrospective (n=138) | | Prospective (n=126) | | p |
|----------------------------------|-----------------------|--------|---------------------|---------|-------|
| | No. | % | No. | % | |
| Post arrest | 1 | (0.7%) | 1 | (0.8%) | 1.000 |
| Post ictal | 5 | (3.6%) | 0 | (0.0%) | 0.061 |
| Disturbed level of consciousness | 64 | (46.4) | 60 | 47.6% | 0.840 |
| Respiratory failure | 50 | (36.2) | 52 | (41.3%) | 0.401 |
| Diabetic ketoacidosis | 3 | (2.2%) | 4 | (3.2%) | 0.712 |
| Myocardial infarction | 2 | (1.4%) | 4 | (3.2%) | 0.429 |
| Shock | 12 | (8.7%) | 5 | (4.0%) | 0.118 |
| Congestive heart failure | 1 | (0.7%) | 0 | (0.0%) | 1.000 |

As regard major complications there was significant improvement in ventilator associated pneumonia (VAP rates). In retrospective study rate of VAP was 55.7% while prospective rate was 31.1% (p:0.001), also there was improvement in rate of central venous catheter(CVC) infection 32.6% retrospective study. Whereas it was 17.8% in prospective one.

There was significant improvement in elevation of head of bed more than thirty degrees as p >0.001(39.9% at retrospective group) and (69.8% at prospective group).

On there the other hand there was no significant improvement in rates of catheter related UTI (p: 0.725), retrospective group was 25.2% and prospective was group 27.5% (Table-4).

According to iatrogenic complications there was significant improvement (p:0.028), retrospective group was 26.1% and prospective group 15.1%.

Also there was significant decrease in drug errors (p: 0.001) retrospective group 79.7% and prospective group 6.3% (Table-5).

There was a significant improvement in administration of DVT prophylaxis as in retrospective group it was 75.4% while in prospective group it was 93.7% P> 0.001 (Table-6).

Table-4. Comparison between the two studied groups according to major complications

| Parameter | Retrospective | | Prospective | | p |
|---|---------------|---------|-------------|---------|---------|
| | No. | % | No. | % | |
| Ventilator associated pneumonia (VAP) | | | | | |
| No VAP | 39 | (44.3%) | 62 | (68.9%) | 0.001 |
| VAP | 49 | (55.7%) | 28 | (31.1%) | |
| Infected central venous catheter (CVC) | | | | | |
| No infected CVC | 58 | (67.4%) | 74 | (82.2%) | 0.024* |
| Infected CVC | 28 | (32.6%) | 16 | (17.8%) | |
| Head of bed elevation >30 | | | | | |
| Non elevated | 83 | (60.1%) | 38 | (30.2%) | <0.001* |
| Elevated | 55 | (39.9%) | 88 | (69.8%) | |
| Catheter related urinary tract infection (UTI) | | | | | |
| No infected catheter | 77 | (74.8%) | 66 | (72.5%) | 0.725 |
| Infected catheter | 26 | (25.2%) | 25 | (27.5%) | |

Table-5. Comparison between the two studied groups according to iatrogenic complications

| Parameter | Retrospective (n=138) | | Prospective (n=126) | | p |
|---------------------------------|-----------------------|---------|---------------------|---------|--------|
| | No. | % | No. | % | |
| iatrogenic complications | | | | | |
| No iatrogenic complications | 102 | (73.9%) | 107 | (84.9%) | 0.028* |
| Iatrogenic complications | 36 | (26.1%) | 19 | (15.1%) | |
| Drug errors | | | | | |
| No | 110 | (79.7%) | 118 | (93.7%) | 0.001* |

Table-6. DVT prophylaxis in retrospective and prospective studied groups

| Parameter | Retrospective (n=138) | | Prospective (n=126) | | p |
|---|-----------------------|---------|---------------------|---------|---------|
| | No. | % | No. | % | |
| Deep venous thrombosis (DVT) prophylaxis | | | | | |
| No | 34 | (24.6%) | 8 | (6.3%) | <0.001* |
| Yes | 104 | (75.4%) | 118 | (93.7%) | |

*: Statistically significant at $p \leq 0.05$

In retrospective group 32.6% was died while 20.6% only died in prospective one which showed significance difference $p = 0.028$ 61.6% was discharged in retrospective group whereas 76.2% was discharged in prospective one with a statistical significant difference. (Table-7).

Table-7. Fate in retrospective and prospective studied groups.

| Parameter | Retrospective (N=138) | | Prospective (N=126) | | P |
|-------------|-----------------------|---------|---------------------|---------|--------|
| | No. | % | No. | % | |
| | Fate | | | | |
| Died | 45 | (32.6%) | 26 | (20.6%) | 0.028* |
| Discharged | 85 | (61.6%) | 96 | (76.2%) | 0.011* |
| Transferred | 8 | (5.8%) | 4 | (3.2%) | 0.307 |

In VAP patient's mortality decreased significantly ($P = 0.018$) after checklist application as showed in table-8.

Table-8. Relation between fate with VAP

| | Fate with VAP | | | | | | p |
|---------------|---------------|------|------------|------|-------------|-----|--------|
| | Died | | Discharged | | Transferred | | |
| | N | % | N | % | N | % | |
| Pre (n = 49) | 27 | 55.1 | 18 | 36.7 | 4 | 8.2 | 0.018* |
| Post (n = 28) | 8 | 28.6 | 18 | 64.3 | 2 | 7.1 | |

Patients with infected CVC there was significant decrease in mortality rates ($P = 0.044$) after application of checklist with more adherence to infection control guidelines. (Table-9).

Table-9. Relation between fate with Infected CVC

| | Fate with Infected DVC | | | | | | p |
|---------------|------------------------|------|------------|------|--------------------------|-----|--------|
| | Died | | Discharged | | Transferred [#] | | |
| | N | % | N | % | N | % | |
| Pre (n = 28) | 18 | 64.3 | 8 | 28.6 | 2 | 7.1 | 0.044* |
| Post (n = 16) | 6 | 37.5 | 10 | 62.5 | 0 | 0.0 | |

More adherence to guidelines that recommended elevation of head of the bed more than 30° shows improvement of mortality rate ($P = 0.049$) as showed in table-10.

In patients that have iatrogenic complications mortality rate decreased significantly ($P = 0.008$) after application of new Alexandria quality checklist as showed in table-11.

Mortality in patients with drug errors decreased significant after application of checklist ($P < 0.001$) as shown in table-12.

Table-10. Relation between fate with Head of bed elevation >30.

| | Fate with Head of bed elevation >30 | | | | | | p |
|---------------|-------------------------------------|------|------------|------|--------------------------|-----|--------|
| | Died | | Discharged | | Transferred [#] | | |
| | N | % | N | % | N | % | |
| Pre (n = 56) | 19 | 33.9 | 33 | 58.9 | 4 | 7.1 | 0.049* |
| Post (n = 87) | 18 | 20.7 | 67 | 77.0 | 2 | 2.3 | |

Table-11. Relation between fate with iatrogenic complications.

| | Fate with iatrogenic complications | | | | | | p |
|---------------|------------------------------------|------|------------|------|--------------------------|-----|--------|
| | Died | | Discharged | | Transferred [#] | | |
| | N | % | N | % | N | % | |
| Pre (n = 36) | 28 | 73.7 | 8 | 21.1 | 2 | 5.3 | 0.008* |
| Post (n = 19) | 8 | 42.1 | 11 | 57.9 | 0 | 0.0 | |

Table-12. Relation between fate with Drug errors.

| | Fate with Drug errors | | | | | | p |
|--------------|-----------------------|------|------------------------|------|--------------------------|---|--------|
| | Died | | Discharge ^d | | Transferred [#] | | |
| | N | % | N | % | N | % | |
| Pre (n= 28) | 2 | 85.7 | 4 | 14.3 | - | - | <0.001 |
| Post (n = 8) | 1 | 12.5 | 7 | 87.5 | - | - | |

DISCUSSION

New Alexandria Checklist applying in (ICU3) was feasible and doable during daily clinical rounds, and minimal resistance was noted during application, but overall compliance was very accepted as the checklist is simple and easy to fulfill.

Application of the checklist for 3 months in (ICU3) showed significant improvement in CVC infection rates and better adherence to guidelines as noted in other checklist used previously in these fields. (4,5,6)

But also mortality rates and VAP rates decreased unlike other studies using checklists as the study by BRICNet et al. in Brazil one of the most recent and the biggest studies in this field.⁽¹⁵⁾ and Ko HC et al study results also⁽¹⁶⁾

This difference may be attributed to the difference setting of the study. Egypt is a low income country with limited budget for healthcare with limited resources and overcrowdings of healthcare service, simple aids to insure adherence to general medical guidelines may be helpful, another cause to differ from other studies in effectiveness in decreasing mortality may be a flaw in the study as regard the nature of each groups patients as APACHE II⁽¹⁷⁾ scores was not measured for each group as an indicator of expected mortality.

On the other hand, the significant effect of checklist in decreasing rates of VAP by insuring general infection control procedures which is checked and improved daily was significant, all the elements of VAP^(18,19) bundle were present at checklist and revised daily:

1. Head of bed elevation at least 30 degrees.
2. Daily sedation interruption.
3. Peptic ulcer prophylaxis.
4. Deep vein thrombosis prophylaxis.
5. Daily oral care.

Implementing the evidence based practice led to a decrease in the incidence of VAP in both surgical and medical patients.

It helped to decrease mean length of stay and mean duration of ventilation in the surgical sub-population. In previous studies. This was clinically significant but not statistically significant.

In these studies, it significantly reduced the incidence of upper GI bleed in the population studied.

Incorporating this bundle in the ICU would help to continue of its use and result in improving patient safety in the intensive care unit

VAP is a major source of increased illness and death. Persons with VAP have increased lengths of ICU hospitalization and have up to a 20-30% death rate and also requires a significant financial cost to be prevented and treated which overall causes decrease in healthcare quality and increased days of ICU stay,^(18,19) so decreasing their rates by simple non-expensive aid such as new Alexandria quality checklist.

CVC infection is a major complication in ICU which subject the patient to serious life threatening complications⁽⁵⁾⁽²⁰⁾ and founded to be preventable by multiple manners included a simple compliant quality checklist.

Communication was presented strongly in new Alexandria quality checklist, and assessed daily between all team members of medical team,

between physician and patients, to ensure that the patient is fully understand his medical case, and all the alternatives presented to participate in discussion making, and with relatives as a way of assurance and guarantee their full understand his relative situation.

Another part is communication between physicians themselves at hand-off and representing the medical cases of each patient.

These elements were checked daily and their improvement mostly have a great effect on outcome of patients.

Drug errors is a very important part of iatrogenic complications as noted Medication errors were common (nearly 1 of every 5 doses in the typical hospital and skilled nursing facility). The percentage of errors rated potentially harmful was 7%, or more than 40 per day in a typical 300-patient facility. The problem of defective medication administration systems, although varied, is widespread⁽²¹⁾.these errors decreased significantly using the new Alexandria checklist as previously discussed .Iatrogenic complications (such as iatrogenic pneumothorax, transportation complications, blood incompatibility, and prolonged unneeded ICU stay) decreased significantly using the new Alexandria checklist as using it as a double check or a revision for all drugs and for important procedure that took place in ICU such as CVC insertion and urinary catheter insertion and in infection control procedures.

But on the other hand in our point of view the study had some limitations such as number of patients, and not addressing the baseline expected mortality of the patient.

CONCLUSION

From this study it was concluded that using of a multifaceted quality improvement intervention, in the form of the use of a checklist during multidisciplinary daily rounds and clinician prompts can improve patient mortality and morbidity with this not expensive time saving tool, and we recommend to perform larger scale trials and to widely spread the application of checklists in ICUs like Egypt with further researches on effect of checklists application in reducing ICU mortality.

Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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