Perioperative quality of care and patient safety

Koers, L.
Chapter 8

Introduction to cognitive aids, creating and implementing cognitive aids

“The fear that people have about the idea of adherence to protocol is rigidity. They imagine mindless automations, heads down in a checklist, incapable of looking out of the windshield and coping with the real world in front of them. But what you find, when a checklist is made well, is exactly the opposite. The checklist gets the dumb stuff out of the way, the routines your brain shouldn’t have to occupy itself with, and lets it rise above to focus on the hard stuff.”

The Checklist Manifesto. Atul Gawande 2009

Koers L, Schlack WS, Preckel B.
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Advances in science and technology enable highly complex care in the operating theatre in a safe way, despite an increasingly sick, frail and elderly patient population. Although rare, unexpected life-threatening perioperative emergencies such as anaphylactic shock, massive blood loss and even sudden cardiac arrest still occur. The management of these emergencies is frequently suboptimal as research shows that operating teams often omit 20-50% of critical management steps.1-5 Other high-risk industries use crisis checklists as memory support to optimise the management of unexpected emergencies. Recently, some hospitals also started using memory aids, or “cognitive aids”, for the treatment of perioperative emergency situations.1-4,7 A cognitive aid is a tool that helps healthcare staff to perform and speed up all the necessary management steps of a critical event. There are several reasons that critical management steps are omitted by healthcare staff in these situations. First of all, the degree of exposure to situations that require certain knowledge and skill is the most important determinant for maintaining this knowledge and skill.8 Although the incidence of most of emergencies is not infrequent, they can be rare for an individual healthcare provider. Research shows that within six months, 40-70% of Advanced Life Support (ALS) course participants would fail an ALS re-examination without additional training.9,10 Healthcare staff will thus lack some of the knowledge and, or skills to be adequately prepared for such an emergency without regular exposure or training. Secondly, it has been proven that when the brain is focused on a complex task, such as performing chest compressions or drawing up drugs, the ability to accurately monitor other things (i.e. communication within the rest of the team, other management steps that are being performed, time) is significantly
impaired.\textsuperscript{10} This is also known as loss of situational awareness. The load that a complex situation places on the brain results in the suboptimal application of knowledge from memory.\textsuperscript{11} Lastly, various cognitive factors that play an important role in decision making can also cause errors or delays in treatment.\textsuperscript{12} An example of this is a “fixation error”, a tunnel vision; an anaesthesiologist could be so fixated on obtaining an oral airway in a difficult airway scenario for instance, that the possibility of a surgical airway is completely forgotten. This will put the patient at risk of developing severe hypoxic injury and even death.

Recently, there has been an increased interest in the use of perioperative cognitive aids. The WHO Surgical Safety and the SURPASS checklist have improved perioperative safety by reducing complications and death by 33-60%.\textsuperscript{13,14} In simulation setting there is ample evidence that surgical teams that use cognitive aids manage simulated emergencies more efficiently and miss less critical steps.\textsuperscript{1-4,6,15,16} We therefore started using cognitive aids for perioperative emergencies in our hospital in 2012. We created a collection of cognitive aids, an emergency manual, for the management of perioperative critical events in collaboration with Stanford University (figure 8.1). The Stanford Emergency Manual\textsuperscript{17} has been developed and extensively tested by an expert team in the field of cognitive guidance for emergency situations.\textsuperscript{7} The emergency manual that we created for paediatric perioperative emergencies (figure 8.2) was based on both our adult emergency manual and the PediCrisis cards from the Society for Pediatric Anesthesia\textsuperscript{18} and was created within an expert team of paediatric anaesthesiologists and intensivists.

\textit{The design}

The adult emergency manual is a collection of 22 cognitive aids and the paediatric manual consists of 18 cognitive aids with emergency algorithms and 4 reference cards for drug doses and equipment sizes. The primary order of the cognitive aids is via the ABCDE approach and they are subsequently organised by alphabetical order (figure 8.1 and 8.2). The table of contents is equipped with colour coded tabs to quickly navigate to the correct algorithm. As the layout of the Stanford manual was found to be effective for use in emergencies after extensive testing, we adopted this design in the layout of our cognitive aids (figure 8.3 and 8.4). We organised the management steps of the individual cognitive aids in a couple of blocks. The first block consists of the “start items.” These items are about informing the team about the emergency in order to create a shared mental model, the appointment of a team leader, in order to facilitate and accelerate decision-making and hereby ensuring progress of management and getting the help and the specific materials necessary to manage the particular crisis. The second block consists of the “primary actions” that need to happen in order to effectively manage the emergency. Third block are the “secondary actions” after the patient is stabilised or after the primary actions are completed. Depending on the algorithms there are additional blocks with differential diagnosis, in order to prevent fixation error and blocks with instructions for use of certain equipment together with explanatory pictures.
| Circulatiestilstand: shockbaar | 1 |
| Circulatiestilstand: niet shockbaar | 2 |
| Reanimatie zwangere | 3 |
| Onverwacht moeilijke luchtweg | 4 |
| Respiratoire insufficiëntie na detubatie | 5 |
| Hypoxie | 6 |
| Bronchospasme | 7 |
| Pneumothorax | 8 |
| Longembolie | 9 |
| Hypotensie | 10 |
| Bloeding/Massaal transfusie protocol | 11 |
| Bradycardie met circulatoire insufficiëntie | 12 |
| Tachycardie met circulatoire insufficiëntie | 13 |
| Myocardischamie | 14 |
| Anafylaxie | 15 |
| Intoxicatie lokale anesthetica | 16 |
| Maligne hyperthermie | 17 |
| Transfusiereactie | 18 |
| Totaal spinaal/epiduraal blok | 19 |
| Brand op OK | 20 |
| Falende O₂-toevoer | 21 |
| Stroomstoring | 22 |

**Figure 8.1** Cover Emergency Manual for the management of perioperative critical events
Figure 8.2 Cover Paediatric Emergency Manual for the management of perioperative critical events
Finally, all the cognitive aids are bundled into a plasticised emergency manual, so that they are easy to clean if necessary. The manual is held together with a ring binder so that the replacement of a specific cognitive aid is easy after an update of guidance or changes in local protocols. The emergency manuals (A4 size) are present in standardised locations in all anaesthetic work areas. They can be found hanging from the ventilators in all the operating theatres and behind the patient beds in the recovery room. They are also placed on all anaesthetic carts for use in the endoscopy suite, interventional radiology department, paediatric MRI, cardiac catheterisation laboratories and in the resuscitation areas of the Accident and Emergency department. Both an A5 paper version and an electronic version with hyperlinks for easy navigation for use on computer or smartphone are also available for all anaesthetic staff.

The content of the manual follows the most current (inter)national guidelines for the specific emergencies. We were convinced that incorporating information on local logistics in the cognitive aids was furthermore invaluable. Pager numbers of specific staff to help (i.e. ENT-consultant, paediatric cardiologist etc.), locations of very specific drugs (i.e. Dantrolene) or equipment (i.e. intraosseous driver, iloprost nebuliser, transjugular pacing kit) and instructions to use certain materials (i.e. pacing mode on defibrillator) are included for example. This is so that no time or attention will be lost during the critical event to look for this information or to explain this information to, for instance, junior staff. The cognitive aids that required multidisciplinary input were created in collaboration with the disciplines involved. The cognitive aid for maternal collapse, for example, has been created in conjunction with the obstetric team. One of the additional advantages of these multidisciplinary cognitive aids is the review and formalisation of certain agreements and protocols, especially on the interfaces of the involved specialities. We uncovered several deficits within our organisation of emergencies, both technical and non-technical, during the creation of the emergency manuals. For example, equipment for nebulising medication during mechanical ventilation was improved. Also, prior to the paediatric difficult airway cognitive aid there was no consensus in our institution regarding the order of steps in the paediatric difficult airway algorithm.

Implementation

There must be a thorough implementation programme in order to ensure that staff will use the cognitive aids during emergencies. Not only do they need to be convinced that the use of cognitive aids will improve their performance, they must also be familiar with the format of the cognitive aids. The emergency manual was introduced in the department by several email alerts, departmental meetings and presentations. We found that use of the emergency manual during multidisciplinary simulation training was essential to the implementation process. This is because it is challenging for staff to incorporate a new routine even if they are aware of the benefits. During high fidelity simulation of anaesthetic emergencies, staff
4. Onverwacht moeilijke luchtweg

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**START**
1. Wie is de teamleider?
2. Start timer
3. Benoem onverwacht moeilijke luchtweg
4. Vraag hulp: *59662, noodknoop
5. Haal moeilijke luchtwegkar en fiberscoop
6. Plaats I-gel (max. 3 pogingen)
7. Adequate ventilatie?
   Nee: benoem inadequate ventilatie
8. Ga terug op 2-handige klapademing
9. Falende ventilatie/desaturatie?
   NOODSITUATIE, zie directe acties
10. Adequate ventilatie? Zie secundaire acties

**DIRECTE ACTIES**
1. Benoem NOODSITUATIE: falende ventilatie/desaturatie en vermeld dat je een noodcricotiome gaat verrichten
2. Is er voldoende hulp? Denk aan noodknoop en chirurgische ondersteuning (*59372/*59375)
3. Vraag coniotomieset — achter anesthesiekar (alternatief: scalp/vinger/bougie-methode)
4. Voer noodcricotiome uit indien binnen 3 min geen ventilatie/desaturatie:
   - bevestig met EtCO₂
   - cave: bij circulatiestilstand laag EtCO₂

**SECUNDAIRE ACTIES**
1. Blijf EtCO₂ monitoren
2. Adequate ventilatie? Nee: NOODSITUATIE en zie directe acties
3. Overweeg bij adequate ventilatie:
   - wekken van patiënt met:
     - sugammadex 16 mg/kg iv
     - naloxon 0,8 mg iv
   - maximale ventilatie
   - ingreep voortzetten met I-gel
   - fiberoptische intubatie door I-gel
   - fiberoptische intubatie
   - blauwe voerder/stylet
   - ander laryngoscoopblad
   - glidescope
4. Bevestig met EtCO₂

**CONIOTOMIESET**

**CHIRURGISCH**

**SELDINGER**

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*Figure 8.3 Difficult airway algorithm*
Figure 8.4 Paediatric pneumothorax algorithm
is trained to effectively use the cognitive aids during pre-briefing of an expected complicated case, during an emergency and during the debriefing of a critical event. Furthermore, the induction programme for all new anaesthetic staff (trainees, consultants, anaesthesia practitioners) focuses on the role of human factors and the use of cognitive aids in critical situations. Trainees are tested about the use and content of the emergency manual in their “fit-to-fly” exams for junior and senior on-call roles. Over time, we are seeing an increase in the use of cognitive aids during emergencies.

**Evaluation**

Although a lot of thought and care went into the design and content of the emergency manual, it is important to continuously evaluate the tool for its effectiveness. What could be clear to the creators during the development of such a manual can be unclear or overlooked at the time of a stressful event by the users of the cognitive aids. With user feedback from simulation sessions and real-life events the manual has been further optimised in the years after the implementation.

It must be emphasised that cognitive aids can by no means replace the expertise or skills of healthcare staff. They are tools to improve expert performance by offloading the brain; to free up space to deal with situations faster and more effectively. Teamwork during an emergency can also improve through the use of cognitive aids. Because the sequence of the treatment steps is dictated, no discussion will arise about the management of the priorities. Each team member can furthermore refer to the management steps on the cognitive aid and obstructive hierarchy can hereby be overcome. In simulation setting, the effectiveness of cognitive aids for emergencies is clearly proven. Additionally, cognitive aids have long time been routine in other high-risk industries. We therefore feel that the absence of clinical outcome research should not stand in the way of widespread implementation of this tool. Future research will mainly have to focus on implementation and optimisation of these tools, just as in aviation.
References


