Perioperative quality of care and patient safety

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Chapter 9
The use of cognitive aids during critical events
The management of anaphylactic shock during percutaneous drainage of a hydatid cyst

“at a cardiac arrest, the first procedure is to take your own pulse”
The House of God. Samuel Shem 1978

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The number of moderate-to-deep procedural sedations outside the operating theatre for complex interventions is continually growing. In order to guarantee patient safety during these potentially high-risk procedures, the multidisciplinary team involved need to be well trained to deal with emergencies. Although every anaesthesia provider is thoroughly trained for handling life-threatening emergencies, these situations rarely occur during routine procedures. Therefore, anaesthesia providers might feel very stressed and unfamiliar when an emergency suddenly arises. It is well-known that the human brain does not perform optimally in such a situation. Therefore, critical steps in the management of unexpected emergencies may be missed. Furthermore, the, for anaesthetic staff, potential less familiar environment outside the operating theatre adds insult to injury. In these situations, cognitive aids can help healthcare providers to not omit any critical treatment steps. Cognitive aids have the potential to improve communication by explicating management steps within the multidisciplinary team. Cognitive aids could therefore improve the quality of patient care in critical situations outside the operating theatre as well. We present a case of a severe anaphylactic reaction during the drainage of a hydatid cyst in the interventional radiology suite, where cognitive aids were successfully used to optimise patient care.

Case presentation
A 35-year-old man, American Society of Anesthesiologists Physical Status II (85kg, 180cm), without known allergies was scheduled to undergo a percutaneous transhepatic drainage of a multivesicular hydatid cyst under deep sedation. The cyst was located in the right liver lobe close to the bifurcation of the portal vein. On admission, the patient had a blood pressure of 112/62 mmHg, a heart rate (HR) of 75 beats per minute (bpm) and a peripheral oxygen saturation (SpO2) of 100%. An 18-gauge intravenous cannula was inserted and 50 mg lidocaine and 2 mg clemastine were given...
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intravenously per protocol, after having performed a standard sign-in procedure\textsuperscript{12,13} Two litres of supplemental oxygen per minute were started by nasal cannula. HR, SpO\textsubscript{2}, electrocardiography, non-invasive blood pressure (NIBP) and exhaled carbon dioxide (etCO\textsubscript{2}) were constantly monitored. After the “time-out procedure”\textsuperscript{13} the sedation practitioner induced sedation by administering 250 mcg alfentanil and a propofol infusion. Sedation depth was targeted at a score of 2 on the Modified Observer’s Assessment of Alertness/Sedation Scale (patient response only after mild shaking). Upon achieving this sedation level, the radiologist started the procedure. Immediately after injecting contrast material into the cyst, content from the cyst spilled towards the right portal vein. Subsequently, the patient developed a sinus tachycardia (106 bpm), hypotension (BP 41/16 mmHg) and stopped breathing. The sedation provider directly called for help and started mask ventilation. Upon arrival of the anaesthesiologist, the sinus tachycardia had increased to a HR of 140 bpm, while NIBP and SpO\textsubscript{2} were unrecordable. Subsequently, no carotid or femoral pulses were palpable. A “No-shock” cardiac arrest scenario secondary to an anaphylactic reaction was declared and cardiopulmonary resuscitation was started. The patient was intubated and ventilated, and 1 mg adrenaline boluses were given intravenously according to Advanced Life Support guidelines during resuscitation.\textsuperscript{14} Shorty thereafter the patient regained return of spontaneous circulation but remained to have a low blood pressure (52/32 mm Hg). A continuous infusion of 0.1 mcg/kg/min adrenaline and 0.08 mcg/kg/min noradrenaline were started without significant improvement of the blood pressure. A medical student was asked to read the cognitive aid for anaphylactic shock out loud, to ensure that all required actions were taken. It became apparent that two interventions had been forgotten. First, no (additional) intravenous fluids had been given. Four bags of crystalloids had been attached to the intravenous stand of the patient, but none of the bags had been connected to the intravenous line of the patient. After realising this omission, the patient received 1L of crystalloids and 1L of colloids. This stabilised the blood pressure (98/67mm Hg). The second omission was the failure to consider corticosteroids. The attending anaesthetist had assumed corticosteroids had already been given, since this is standard before percutaneous hydatid cyst drainage. However, this was not the case. The patient subsequently received 50 mg prednisolone intravenously. Ten minutes later the patient was transferred to the intensive care unit in a haemodynamically stable condition.

**Outcome and follow-up**

The patient was successfully extubated the following day, and the patient was discharged home in a good condition 2 days later. Follow up 6 weeks and 6 months later revealed no significant residual symptoms or neurological sequelae in the patient.
Discussion

Percutaneous treatment of a hydatid cyst is usually performed under deep sedation outside the operating theatre. The healthcare team consists of a sedation specialist, an interventional radiologist and a radiology technician. An anaphylactic reaction during drainage of hydatid cyst is rare (1.7%) but carries a mortality rate of 0.03%. Therefore, it is important that healthcare staff react promptly and adequately in this situation. Sedation practitioners in our institution are trained to anticipate and manage emergencies during high fidelity simulation. However, this training alone can’t guarantee that no treatment steps are missed. As corroborated by many reports in the literature, this case also shows that healthcare staff miss essential treatment steps, even if they have regular training in emergency situations. Cognitive aids—properly designed and used —can help in reducing the number of omitted steps and improve communication within the team during a crisis situation. Cognitive aids help to off-load the team’s cognitive load by providing a memory-aid of the critical treatment steps of an emergency. This will allow the team to deal more effectively with the crisis. Although in the presented case the medical team took important management steps before using the cognitive aid, two important treatment steps would have been missed—or at least delayed— without the use of a cognitive aid.

It must be emphasised that cognitive aids can never replace the expertise or skills of medical personnel, but they reduce human error and hereby improve quality of care. Systematic and timely use of cognitive aids will reduce the omission of any steps when dealing with an emergency. In the presented case we can’t be sure that the outcome of the patient would have been worse without the use of a cognitive aid. However, important management steps were missed, and the patient’s condition improved after carrying out the initially omitted management steps.
References