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Book Review

Perfusion Crisis Manual

BOOK TITLE AND THESIS

The *Perfusion Crisis Manual* (PCM) comes from Perth, Australia, and is the third in the series of crisis manuals by Leeuwin Press <https://leeuwinpress.com.au>. The PCM is a collection of cognitive aids presented in aviation checklist format characterized by enumerated actions to guide the perfusionist in crisis management.

AUTHORS

The manual is written by three anesthesiologists with 60+ years of cardiac anesthesia, ECMO, and perfusion experience: Paul Sadleir, Stephen Same, and David Borshoff. They worked with perfusionists Pragnesh Joshi, Ann Ngui, Mark Snider, Anton Van Niekerk, Ken Williams, Paul Rodoreda, Kristine Wardle, Warren Pavey, and Ross Baker to simulate the crisis scenarios.

CONCEPT

The manual minimizes error-prone human factors and emphasizes resource management with a print layout based on aviation checklist design to respond to perfusion crises. This reduces the cognitive load for perfusionists managing a time-critical event. In other words, unnecessary actions are removed from the working memory, and only those actions needed to solve a problem are used.

APPEARANCE AND DESIGN

The cover color is a transition from dark to bright red, like venous and arterial blood, designed to catch the eye in a crisis situation. There is no table of contents. Instead, there is an index of colored tabs and bulleted directives designed to lead the eye quickly to the necessary crisis intervention checklist. This minimalist layout provides an intuitive design that is a cognitive aid in crisis management. The authors state that the interventions were written following evidence-based guidelines, when available. Otherwise, they were supported by references and professional consensus. However, in keeping with the simplistic approach to the manual design, there are no sources cited. Last, the interventions were tested in crisis simulations.

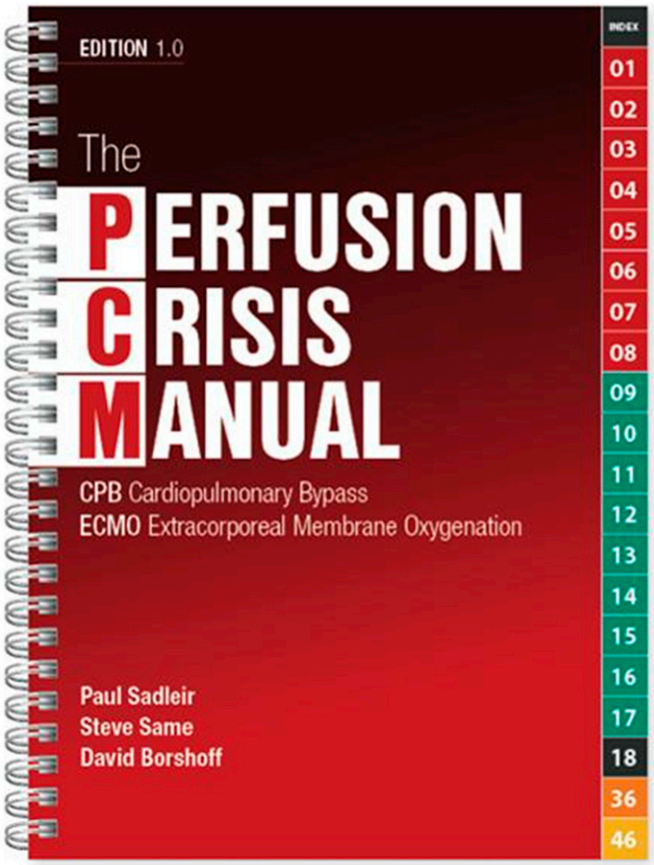

Figure 1. Perfusion Crisis Manual front cover.

CONTENT

The first section, "Heart & Great Vessels" contains eight crisis checklists including items such as "aortic dissections," "massive hemorrhage with redo-sternotomy," and "poor venous return." "Monitored Parameters" contains nine crisis checklists such as "failure to rewarm," "hyperkalemia," and

"malignant hyperthermia." "Blood Components" contains 11 parts with "bleeding post bypass," "heparin resistance," and "sickle cell disease" being three examples. "Equipment Failure" has six parts such as "circuit leak," "failure to oxygenate," and "sudden arterial pump failure." "Emergency Procedures" has nine parts such as "emergency pump set up," "oxygenator change out," and "unexpected circulatory arrest." Last, "ECMO Circuit Procedures" has nine parts with three examples being "air in circuit," "clotting in circuit," and "low flow." In total, there are 55 crisis checklists.

Most checklists have an addendum in smaller type with additional information about the effects, causes, and management of each crisis. These addenda are intended to be complementary information to be studied well before any actual crisis occurs. For example, in the "emergency pump set up" checklist, item 3 says "Complete the four critical attachments (FLOP)." FLOP is an acronym explained in the addendum as 1) Flow probe, 2) Level sensor, 3) Oxygen tubing attached to oxygenator, and 4) Pressure monitor (circuit arterial line).

STRENGTHS AND WEAKNESSES

Aviation checklists work best when there are two pilots: one flying the plane and the other reading the checklist and performing the troubleshooting. So, this tool would work best in an n+1 perfusionist program.

The scenarios assume the immediate availability of backup pumps and specific disposables and tubing pack design. The checklists themselves are in boldface type for easy reading, with large spacing between each step if the reader needs to make notations due to local idiosyncrasies. This will be necessary because the steps are based on the Perth program's use of specific disposables and equipment. Other programs may want to make modifications to the specific steps outlined. For example, I agree with their checklist for sickle cell patients using 100% O_2 sweep gas and exchange transfusion if hemoglobin S is greater than 30%, but I do not agree with their oxygenator changeout using an 'in series replacement' technique rather than a 'in parallel replacement' technique. So, I would modify that section of the manual.

I think the checklists were well-written, effectively organized, and easily followed. As to their future proof ability, they are likely to be relevant for a good while. But they depend on the technology and principles that are likely to change in the decades ahead.

Last, there is no focus on how to avoid these crises, many of which are preventable, from occurring in the first place by using pre-emptive management. However, avoiding a crisis is not the purpose of a manual focused on "managing time-critical events."

SIMILAR BOOKS OR MANUALS

To my knowledge, there is no comparable perfusion safety–oriented manual or book. Perfusion texts primarily deal with the physiology and techniques of perfusion practice. Sometimes, they include short troubleshooting sections but not to the extent and specificity of this manual.

COST

The PCM North American Edition is AUD $65 plus delivery and comes with a digital copy. The website cautions that delivery may be delayed due to COVID-19.

HOW SHOULD THIS MANUAL BE USED?

The manual lives up to its goal of providing cognitive support in a perfusion crisis although they are rare events. Nevertheless, the manual is likely to be used frequently because it provides material for simulation training, teaching, and crisis management rehearsal. Ideally, it will be used as a training tool, especially for students. By performing a simulation scenario or even a tabletop discussion of a different crisis in the manual weekly, a perfusion team can prepare for many potential hazards before they occur.

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