

Title: CRITIQUING AN ANESTHETIST'S PLAN: THE ATTENDING SYSTEM  
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ATTENDING<sup>(1)</sup>, a computer system built using artificial intelligence (AI) techniques, has been developed to critique a preoperative plan for anesthetic management. Input to ATTENDING includes 1) a list of a patient's medical problems, 2) the planned operation, and 3) a list of the techniques and agents proposed for premedication, induction, intubation, and maintenance of general or regional anesthesia. ATTENDING then critiques this plan by analyzing the risks and benefits of the proposed approach as compared to other reasonable approaches.

Initially, the system will be used to allow anesthesiologist self-evaluation, with the computer describing hypothetical patients for consideration. In this tutorial mode, ATTENDING can be experimentally evaluated with a small data base, since it need only know about those medical problems which relate to the hypothetical cases.

#### An Example

To permit anesthesiologist self-evaluation, ATTENDING first describes a hypothetical case:

"A SIXTY YEAR OLD MAN, WITH A LONGSTANDING HISTORY OF CHRONIC RENAL FAILURE AND A PRIOR STROKE, COMES TO THE OR FOR REPAIR OF A METAL SPLINTER EMBEDDED IN HIS RIGHT EYE. HE RECENTLY ATE LUNCH."

The anesthesiologist then proposes a plan for anesthetic management, e.g.:

1. induction with thiopental
2. rapid sequence intubation using succinylcholine
3. maintenance using halothane, curare, nitrous oxide, and oxygen.

ATTENDING'S current prototype implementation produces the following critique of this plan:

"THERE ARE A NUMBER OF BASIC PRINCIPLES INVOLVED IN THIS PATIENT'S MANAGEMENT. FIRST, IN THE PRESENCE OF A FULL STOMACH, ONE MUST ATTEMPT TO PREVENT ASPIRATION. SECOND, A PATIENT WITH A PENETRATING EYE WOUND MUST BE PROTECTED FROM INCREASED INTRAOCULAR PRESSURE. THIRD, IN A PATIENT WITH CHRONIC RENAL FAILURE, ONE MUST CONSIDER THE PROBLEM OF COMPROMISED EXCRETION OF DRUGS.

"INTUBATION OF THIS PATIENT IS CLEARLY IMPORTANT BECAUSE OF A FULL STOMACH. RAPID SEQUENCE INTUBATION IS A REASONABLE APPROACH. THE CHOICE OF SUCCINYLCHOLINE, HOWEVER, COULD HAVE TWO POSSIBLE RISKS. FIRST, IF THE STROKE IS RECENT AND INVOLVES HEMIPARESIS, THERE IS THE RISK OF LIFE-THREATENING HYPERKALEMIA. SECOND, THERE IS THE RISK THAT SUCCINYLCHOLINE COULD CAUSE EYE

MORBIDITY FROM INCREASED INTRAOCULAR PRESSURE. AN ALTERNATIVE WOULD BE HIGH DOSE PANCURONIUM. HERE, HOWEVER, IN A PATIENT WITH CHRONIC RENAL FAILURE, THERE IS THE RISK THAT IT COULD CAUSE PROLONGED POSTOPERATIVE PARALYSIS DUE TO COMPROMISED RENAL EXCRETION. THUS, THERE IS NO IDEAL WAY TO PERFORM RAPID SEQUENCE INTUBATION. AN ALTERNATIVE APPROACH, PERHAPS, TO RAPID SEQUENCE INTUBATION WOULD BE INTUBATION AFTER MASK INDUCTION WITH CRICHOID PRESSURE.

"LOOKING AT THE OTHER ASPECTS OF THE PROPOSED PLAN, CURARE AND HALOTHANE ARE APPROPRIATE CHOICES FOR A PATIENT WITH CHRONIC RENAL FAILURE."

As can be seen, ATTENDING'S critique starts with a short discussion of the relevant principles of management. Then a matter-of-fact analysis of the plan is produced. In this analysis ATTENDING emphasizes, as much as possible, the appropriate aspects of the proposed plan (on the theory that advice is best received when presented in as positive a context as possible).

#### Overview

ATTENDING has been developed using AI techniques. In contrast to ATTENDING'S approach, most existing AI systems in medicine<sup>(2,3)</sup> focus on trying to simulate (rather than critique) a physician's decision-making process. Thus, these systems attempt to imitate a physician and thereby, in practice, try to tell him what to do. This approach has major social, medical, and medicolegal drawbacks.

The ATTENDING system differs in that it assumes that its physician user has already evaluated a patient and formulated a tentative management plan. ATTENDING gives the physician feedback to help him refine and optimize the plan. Critiquing a physician's plan represents a new approach to computer-assisted medical decision-making, which may well prove to be both practical and clinically appropriate.

#### References

1. Miller PL: ATTENDING: A system which critiques an anesthetic management plan. Proceedings of the American Medical Informatics Association Congress 82, San Francisco, May 1982.
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3. Shortliffe EH, Buchanan BG, Feigenbaum EA: Knowledge engineering for medical decision making. A review of computer-based clinical decision aids. Proc IEEE 1979; 67:1207-1224.