TITLE: AN EXPERT SYSTEM TO TEACH HOW TO TROUBLESHOOT COMMON PROBLEMS OF AN AUTOMATED ANESTHESIA RECORDKEEPER

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Introduction. This institution has installed automated anesthesia recordkeepers in all its general operating rooms. Automated records from these instruments serve as the official chart record in over 90% of cases done.

These are complex devices, both to operate and to troubleshoot. The most common troubleshooting calls are for printer problems and for failure of the patient monitors to communicate data. Each of these problems may have several different causes. It is difficult for residents or CRNA's to become expert in solving these problems, because a specific problem may occur only once every several months for each person.

Method. A major topic in computer science today is the field of artificial intelligence and expert systems. Such systems permit the computer to serve as an expert advisor for business, industrial, medical, and other applications. In the past, expert system programs have been difficult, tedious, and expensive to develop, because of the need to program sophisticated technical knowledge into a specialized computer language. More recently, several expert system "shell" programs have been developed. These permit an untrained computer user to generate his or her own expert system. One such program is "1st Class Fusion." This program has the specific advantage of being able to generate expert system "rules" merely through the entry of examples. In other words, a developer need only enter the values for several variables under specific conditions. The program then generates all the relevant rules to render a diagnosis in future cases, based upon these examples.

Results. We have used 1st Class Fusion to create a prototype expert system for diagnosis for recordkeeper problems. For example, the program for printer problems asks the resident or CRNA to check the paper. Has the paper run out? Is the paper jammed? In these cases the program provides a step-by-step procedure for rethreading the paper. The program also reminds of the need to check the position of two paper feed switches on the printer. Next, the program asks about the status of some indicator lights on the printer and explains how to correct these situations. Finally, the program asks about printer alignment problems. It then explains how to get the paper aligned properly.

The companion program for communications problems proceeds through a list of what data values are and are not being recorded. The resident or CRNA is asked to check specific cable connections on the monitors, specific cable types, and specific plug-in ports on the recordkeeper. Finally, if the problem cannot be solved, the pager number for the recordkeeping assistant is provided.

Discussion. This system operates on a battery-powered portable laptop computer. It can be carried into the operating room and used to provide the resident or CRNA with an "expert" at his or her elbow. In this way, the vast majority of printer and communications problems can be solved without outside assistance. There are also psychological benefits in that most users are happier when they are can "solve the problem themselves." The users can then learn how to troubleshoot the recordkeeper without realizing that they are learning.

UTILIZATION OF MUSCLE RELAXANTS: A COST ANALYSIS

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Introduction: The use of intermediate-acting non-depolarizing muscle relaxants has increased since their introduction in the mid-1980's. In order to assess the clinical and financial impact these agents have had on our practice, we analyzed a typical week's cases to determine the appropriateness and cost of their use.

Methods: We reviewed one week's anesthetic records from the general OR. Of the cases requiring the use of a muscle relaxant, we recorded the muscle relaxant(s) used, duration of case, dose(s) used, and who gave the anesthetic (CRNA, Resident, Staff). We then determined whether a long-acting muscle relaxant could have been substituted, based on the following criteria: 1.Duration of neuromuscular blockade (time between induction and reversal) greater than 90 minutes (1.5 hours). 2. No specific indication to use an intermediate-acting relaxant, such as tachycardia (HR>90), renal insufficiency, or question as to the duration of the case (e.g. arthroscopy). We calculated the cost of the muscle relaxant(s) used, and estimated the cost of substituting pancuronium in those cases meeting the above criteria. The estimated dose of pancuronium was based on 1 mg=1 mg for vecuronium, and 1 mg=5 mg for atracurium.

Results: 139 cases required muscle relaxant, of which 105 cases used an intermediate-acting drug. Out of these cases, 81 met the criteria for substituting a long-acting relaxant (77%). 40/81 were done by a CRNA, 41/81 by a resident. The average duration of a case was 146 minutes (2 hr 26 min). The costs of the muscle relaxants were:

Drug	Cost	#cases used	# meeting criteria
Succinylcholine	200 mg/$0.67	12	
Vecuronium	10 mg/$11.80	98	79
Atracurium	50 mg/$15.68	7	2
Pancuronium	10 mg/$3.99	22	
		139	81

The costs of muscle relaxants used for the week totaled $1213.89. If pancuronium had been substituted where acceptable, the estimate would be $577.42, a 52% savings.

Discussion: With the introduction of the intermediate-acting muscle relaxants vecuronium and atracurium in the mid-1980's, questions arose as to the cost-effectiveness of their use.[1] In our institution, the intermediate-acting muscle relaxants were used in 76% of cases in a one-week period. 77% of the time, a cheaper alternative could have been chosen. Projected over a one year period, judicious use of muscle relaxants could result in a savings of over $30,000. Certain indications do exist for the intermediate-acting agents, including hemodynamic stability,[2] hepatic or renal dysfunction,[3] and shorter procedures, but in a majority of cases an alternative could be used. This study focused on only one class of agents utilized in anesthetic practice; similar situations exist with other agents and anesthetic techniques. In the present climate of medical cost-containment, anesthesiologists must bear in mind the expenses of practice choices, and not simply turn to the agents popularized in the current marketing media.

References:
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