

A Cyberday in the Life

At 9 PM Sunday, February 5, 2006, Dr Susan Scott returned home from a weekend of cross-country skiing, tucked her children in bed, sank down on the couch in front of her large-screen three-dimensional information center and home entertainment unit, and spoke into the remote-controlled microphone: "Logon Hospital." Five seconds later the voice synthesizer in her terminal replied, "Welcome to the General Hospital HMO computer system. Identity, please." She pressed her thumb against the fingerprint reader in her handheld keypad, then entered her code to confirm her identity. A priority e-mail message informed her that two of her patients had been admitted.

The admitting diagnosis for Clara Smith, an 82-year-old widow, was congestive heart failure. Susan called up and reviewed the admission notes the resident had dictated into the hospital computer. They indicated that the chest radiograph was equivocal: there was an alveolar process that could represent either heart failure or an infiltrate. She said "Chest x-ray," and the most recent image appeared on the screen: there were perihilar infiltrates, but the infiltrate in the left lung was much more prominent. She thought the image was more suggestive of pneumonia than heart failure and said "Infection findings." The screen filled with selected data: vital signs, including a temperature of 37.7°C; a white blood cell and band counts, slightly elevated; normal rapid serum bacterial antigen and interleukin-6 assays; and pending sputum and blood cultures. "It could be failure," she concluded, "but I'll bet she has pneumonia." She reviewed the medication orders and noted that no antimicrobial agent had been included. She instructed the computer to page the covering resident and convinced him to add an antibiotic.

Mrs Smith had been Susan's patient for 12 years. She reflected on her patient with affection and concern and thought, "She must be scared out of her wits. She doesn't know those young doctors, and she may think they're uncertain about what's going on. I'll give her a call." Activating her home telemedicine video system, Susan dialed Mrs Smith's bedside television. Seeing that her patient seemed to be dozing, she said softly, "Mrs Smith, this is Dr Scott, up here on the television. Are you awake?"

"Oh my goodness, Dr Scott," the patient exclaimed, sitting up with a start. "How wonderful to see you!"

"Evening, Mrs Smith. I've just reviewed all your tests and treatments. We're not sure whether you have heart failure or pneumonia, but we're treating you for both. I'll be in to see you first thing in the morning."

Susan's second patient was 45-year-old Edward Martin, a long-time cigarette smoker with hypertension admitted with chest pain. The initial data indicated that nondiagnostic changes had been present on his electrocardiogram and two of the five myocardial injury proteins were borderline abnormal, but the positron emission scan showed no evidence of focal wall-motion abnormalities. Dr Scott then said "ECG" and the tracing flashed on the screen, showing lateral T-wave inversions. She called up previous ECGs: the T-wave changes were definitely new. Given these data, the patient's risk factors, and answers to five questions on the current illness history, the computer reported that the chest pain algorithm estimated risk of myocardial infarction of 10%. This met the HMO's criteria for admission, which were based on regularly updated data from a consortium of HMOs covering a population of 17 million people. "That estimate has to be low. I won't be surprised if he rules in," Susan predicted to herself. The computer frequently volunteered such probabilities and related advice as to whether a particular action was recommended. She liked to compare her predictions to the computer's and felt that she could often do better. Her HMO allowed

physicians to make the medical decisions about issues like admission, regardless of the computer's "advice," although the HMO tracked deviations from the recommended actions and monitored outcomes. The decisions and patient outcomes of all physicians were tabulated and evaluated by peers.

Susan then turned to her regular electronic mail, which grouped her messages into those from patients and those from colleagues. She looked through her patient mail first. Susan's HMO gave a simple computer to all its members who didn't have one, because making more transactions electronic had been found to improve efficiency and satisfaction. One patient with hypertension whose recent pressures had been consistently higher than the parameters Susan had given him had transmitted five blood pressure measurements. After increasing the dose of one of his antihypertensive medications, Susan clicked on the "Refill" icon, thereby updating her medical record for the patient, sending his pharmacy the refill request attached to her electronic signature, and sending an electronic mail message notifying the patient to increase the dosage and that a refill had been ordered.

Four other patients had sent messages. One patient whose brother had AIDS asked about a gene therapy she had read about on an electronic bulletin board. Susan knew there were no ongoing clinical trials being conducted, and she didn't think there was good evidence other than anecdotal reports supporting such treatment. She called up the Global Infectious Disease Society's (GIDS's) Web Site and found that a recent expert panel agreed with her. In her reply to the patient's e-mail, Susan called gene therapy for AIDS "promising but unproven" and included in her reply a copy of the GIDS's statement on the subject designed for the public. Online lay versions of medical textbooks and electronic bulletin boards meant that patients were better informed than ever before, but the number of questions she received made Susan feel they were a mixed blessing.

The next morning Susan arrived at the hospital a few minutes earlier than usual to round on her two new inpatients before starting her office practice. First, she visited Mr Martin. At the terminal outside his room, she reviewed his most recent vital signs, laboratory data, and ECG studies. Surprisingly, the second set of myocardial injury markers was normal, and his ECG had not changed. Myocardial infarction had been ruled out; her intuition had been wrong.

Susan went into the patient's room and after some pleasantries asked, "Could you tell me what the chest discomfort you had yesterday was like?"

"It started after I finished shoveling snow, and my chest just felt tight, like someone was squeezing me. I couldn't get my breath. I sat down on the curb, and it finally went away."

"How long did it last?"

"I didn't look at my watch, but I'd say about 10 minutes."

This description concerned Susan, particularly in light of the earlier myocardial injury markers and ECG changes. The patient's position on the critical pathway for chest pain was displayed by the computer: the recommended plan was to discharge him if his nuclear exercise test, already scheduled for this morning, was normal. Critical pathways, developed by multidisciplinary teams within the organization, resulted in standardization of much routine care. Susan liked pathways, in part because she felt that the system allowed her more time to talk with patients, which she valued more than the technical side of medicine. She spent 10 more minutes with Mr Martin, joked with him about the stress of having teenage daughters, and emphasized the importance of quitting smoking.

Susan then visited Clara Smith. Blood cultures revealed an as-yet-unidentified gram-positive coccus in clusters. Based on