USE OF AN EXPERT SYSTEM, RENEX, TO DETERMINE THE NEED FOR FUROSEMIDE IN PATIENTS WITH SUSPECTED RENAL OBSTRUCTION

Andrew Taylor, MD, Ernest V Garcia, PhD, Raghuveer Halkar, MD, Russell Folks, CNMT and Meghna Krishnan, MS; Radiology, Emory University School of Medicine, Atlanta, GA, United States.

Objectives: In the evaluation of suspected renal obstruction, a recent international consensus panel has recommended baseline imaging followed by furosemide administration (O'Reilly et al. J Nucl Med 1996). Baseline imaging is sufficient to exclude obstruction in a number of patients and the additional imaging time can be avoided. This prospective study was performed to compare the decision regarding the need for furosemide made by a renal expert system (RENEX) with the need for furosemide determined by expert readers and by the actual clinical decisions.

Methods: Normal limits were established for 47 parameters extracted from the Tc-99m MAG3 scans of 100 potential renal donors. From these data, 5 boundary conditions were estimated for each parameter: (1) definitely abnormal, (2) probably abnormal, (3) equivocal, (4) probably normal and (5) definitely abnormal. These boundary conditions were then used to create a parameter knowledge library for converting the value of each individual patient quantitative parameter to a certainty factor. Sixty heuristic rules (IF A THEN B) were extracted from a domain expert to generate a knowledge base for detecting obstruction and determining if furosemide was needed to exclude obstruction. The system was trained using a pilot group of 31 adult patients (61 kidneys) referred for suspected obstruction. Two experts scored each kidney for the need for furosemide and resolved differences by consensus. The system was then prospectively tested in another 34 adult patients referred for suspected obstruction; 17 received furosemide and 17 did not. Results were compared with expert scoring as above and with the actual clinical decision to give or withhold furosemide.

Results: In the prospective study, RENEX recommended furosemide in 100% (17/17) patients who were given furosemide in the clinic and concluded furosemide was unnecessary in 88% (15/17) who did not receive it. RENEX agreed with the expert consensus in 88% (30/34) of patients and in 93% (63/68) kidneys. In 3 patients (4/68 kidneys), RENEX recommended furosemide when the experts concluded it was not necessary and recommended against furosemide in only 1/34 (3%) of patients (1/68 kidneys) when the experts deemed it necessary. Conclusions: RENEX showed excellent agreement with the expert/clinical decision to give or withhold furosemide. Use of RENEX as a decision support tool in the baseline plus furosemide protocol may help avoid unnecessary studies and save technologist, camera and patient time.