

**A New Device for Preventing Medication Infusion Errors and Venous Air Embolisms Using a Microfluidic Chip to Measure Specific Gravity**

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**Purpose:** To develop a new microfluidic chip for use in preventing medication delivery errors due to the wrong medication and concentration and to detect air bubbles for venous air embolism prevention. This new micromachined sensor utilizes specific gravity measurements to accomplish this purpose.

**Methods:** A microfluidic sensor chip, based on micromachined resonant tube technology was evaluated for its ability to distinguish a variety of IV solutions and drugs. Sterile water, air, saline, dextrose and heparin solutions were tested with the microsensor system. Plots of concentration versus specific gravity were obtained. Statistical analysis of the data was employed to determine if measurement differences were significant.

**Results:** All IV solutions examined could be distinguished via specific gravity measurements with 3 digits of accuracy. Concentration plots of NaCl and dextrose in water were very linear  $R^2 > 0.999$ . Differences between the specific gravity of heparin and heplush® could be identified with statistical certainty,  $t=237$ . Air bubbles could be easily identified given the 3 orders of magnitude difference in specific gravity between the two fluids.

**Conclusion:** A new validated method of identifying a variety of IV solutions and air bubbles using a microfluidic chip that measures specific gravity has been developed. Since microchip technology is employed the method offers a potentially cost effective means of monitoring IV solutions with a disposable device. A number of medication delivery errors and venous air embolisms can be prevented with this new microsensor.