CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

36650

Project Title

Which Intravenous Fluid Is Best for Sepsis?

Abstract

Objectives/Goals

To study the effect of normal saline, Ringer#s lactate, 5% dextrose in half normal saline (D5 ½ NS) and 3% saline on bacterial solutions (Escherichia Coli and Staphylococcus Aureus) in vitro.

Methods/Materials

Using known controls for Staphylococcus Aureus (S. Aureus) and Escherichia Coli (E. Coli) and the Prompt Inoculation System-D, a standardized bacterial suspension of each bacterium was prepared. 20 µl of S. Aureus bacterial suspension was added to 5 tubes each containing 3 ml of sterile inoculum water, and 20 µl of E. Coli bacterial suspension was added to 5 tubes each containing 3 ml of sterile inoculum water. One tube was used as a control for each bacterium. 3 ml of normal saline, Ringer#s lactate, D5 ½ NS and 3% saline respectively were added, one in each of the 4 remaining tubes. After mixing the solutions well, 100 µl of each solution was plated on to blood agar plates. After incubating overnight at 37º C with 5% CO2, the number of colonies on each plate was counted.

Results

For E. Coli, the average colony counts were least with 3% saline (98.3), followed by D5 ½ NS (112), normal saline (120.3) and Ringer#s lactate (128.6).

For S. Aureus, the average colony counts were least with normal saline (253.7), followed closely by 3% saline (254.3), then Ringer#s lactate (256.3) and D5 ½ NS (269.3).

Conclusions/Discussion

For E. Coli, there was least bacterial growth with 3% saline (most hypertonic fluid) which was statistically significant. This was followed by D5 ½ NS (also hypertonic but less than 3% saline) compared with the isotonic fluids (normal saline and Ringer#s lactate). These findings indicate that the tonicity of the IV fluid made a difference in controlling growth of E. Coli (a prototypic gram negative bacterium). For S. Aureus the results were more variable and no definite conclusion as to whether any of the fluids worked better could be drawn. The tonicity of the fluid used did not seem to have an effect on S. Aureus (a prototypic gram positive bacterium). The difference in the effect of hypertonic solutions on Gram negative versus Gram positive bacteria is likely related to the difference in the structure of their cell walls. My study indicates that use of hypertonic IV fluids (like 3% saline and D5 ½ NS) may be a better choice for patients with sepsis due to gram negative bacteria like E. Coli.

Summary Statement

My study shows that use of hypertonic IV fluids (like 3% saline) may be a better choice for patients with sepsis due to gram negative bacteria like E. Coli.

Help Received

Victoria Go, CLS gave me advice and taught me the proper procedures for conducting my experiments. My sister Andrea helping me to conduct statistical analysis.