Magnesium Sulfate Dilution Bottle

Health need

The World Health Organization estimates that preeclampsia and eclampsia (PE/E) account for at least 14% of maternal deaths in low-resource settings. In 2011, WHO developed evidence-based recommendations for the prevention and treatment of PE/E, and identified magnesium sulfate ($MgSO_4$) as the anticonvulsant of choice in cases of severe PE/E. Despite its endorsement by WHO and its presence on most national essential medicines lists, $MgSO_4$ is still underused, incorrectly administered, or unavailable in many low-resource settings due to a combination of provider and supply factors. For example, the current WHO regimen for $MgSO_4$ is extremely complex and requires intravenus (IV) and intramuscular (IM) administration, different concentrations of $MgSO_4$ for IV (20%) and IM (50%) doses, and different doses for IV, IM, loading, and maintenance doses. Additionally, there are multiple concentrations of $MgSO_4$ currently available on the market, making the calculation of dosing and dilution even more complex and confusing.

Technology solution

PATH has adapted the concept of a dilution bottle to simplify the process of $MgSO_4$ administration. A dilution bottle bottle can facilitate the safe calculation of recommended doses by obviating the need to remember complex equations for dilution, which could eliminate the chance that the wrong dilution will be administered. PATH's dilution bottle could also reduce the burden associated with procurement and inventory control since only one type of dilution bottle needs to be procured and stocked for the treatment of PE/E. PATH's dilution bottle contains a 50% $MgSO_4$ solution and is furnished with a rubber septum that self-seals after needle insertion. When a 50% $MgSO_4$ solution is required, the necessary amount can be withdrawn directly from the bottle. Alternately, by eliminating the need for a calculation for a dilution of $MgSO_4$, the bottle is pre-marked with a fill line; a health care worker can simply add sterile water (diluent) to the bottle up to the fill line, making the 50% $MgSO_4$ solution a 20% $MgSO_4$ solution.

Current status and results

PATH is currently identifying how much headspace is required between the dilution and the top of the cap in the dilution bottle to reduce pressure and enable a smooth withdraw of $MgSO_4$ solution from the bottle. We are also investigating what composition material will be optimal to ensure that the fill line mark is clearly visible. Subsequently, in collaboration with potential manufacturers, we will estimate the itemized production cost of the dilution bottle. Our next steps will be to evaluate user acceptability and feasibility as well as policy and regulatory environments.

PATH/Patrick McKern

Prototype examples magnesium sulfate dilution bottles.

"The underutilization of $MgSO_4$ has led to a global call for workable, sustainable ways to increase access to and use of $MgSO_4$…. innovations may support access to and safe administration of $MgSO_4$."

Delivery of Magnesium Sulfate, Technology Opportunity Assessment. PATH, 2013 [Unpublished].

Availability

For more information regarding this project, contact Mutsumi Metzler at mmetzler@path.org.

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