

Antenatal Magnesium Sulphate (Mgso4) for Fetal Neuro-Protection Prior to Preterm Labor: Mini-Review

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Abstract

Background: Cerebral palsy (CP) is a motor and/or cognitive dysfunction affecting the low birth weight (LBW) infants, and infants delivered preterm before 34 gestational weeks. Authors recommended the Magnesium Sulphate (MgSO₄) infusion for prevention of CP in preterm infants delivered before 34 gestational weeks.

Objectives: This mini-review article designed to highlight the value of antenatal Magnesium Sulfate (MgSO₄) infusion before 34 gestational weeks in reduction of the cerebral palsy incidence associated with preterm labor (PTL), and low birth weight (LBW).

Materials and Methods: A PubMed search done between 2002 to 2009 using the words; Mg Sulphate (MgSO₄), and fetal neuro-protection. The retrieved articles were critically analyzed to highlight the value of antenatal Magnesium Sulfate (MgSO₄) infusion before 34 gestational weeks in reduction of the cerebral palsy incidence associated with preterm labor (PTL), and low birth weight (LBW).

Results: Conde-Agudelo et al, found that the MgSO₄ infusion to women at risk of labor before 34 weeks reduces the risk of CP, without any significant maternal side effects or complications^[1]. In addition; Rouse et al, reported that the MgSO₄ reduced the risk of moderate or severe CP in infants of singleton pregnancies (RR 0.52, CI; 0.27–0.98)^[2].

Recently; Doyle et al, meta-analysis reported that the antenatal MgSO₄ infusion before 37 gestational weeks to women at risk of PTL associated with reduced CP risk (RR 0.68, CI; 0.54–0.87), and gross motor disabilities (RR 0.61, CI; 0.44–0.85) in their children (RR 1.04, CI; 0.92–1.17)^[3].

Conclusion: Ante-natal MgSO₄ infusion before 34 gestational weeks could be useful in cerebral palsy prevention in preterm infants, without any significant maternal side effects or complications.

Keywords: MgSO₄, Neuroprotection, CP, PTL.

1. INTRODUCTION

Cerebral palsy (CP) is a motor and/or cognitive dysfunction affecting the low birth weight (LBW) infants, and infants delivered preterm before 34 gestational weeks^[4].

Many authors recommended the Magnesium Sulphate (MgSO₄) infusion for prevention of CP in preterm infants delivered before 34 gestational weeks^[5].

Although; Magpie trial, concluded that the lower risk of eclampsia following prophylaxis with MgSO₄ was not associated with a clear decrease in the risk of death or disability for infants at 18 months^[6]. A Cochrane meta-

analysis reported that the antenatal MgSO₄ infusion before 37 gestational weeks to women at risk of PTL associated with reduced CP risk in their children (RR 0.68, CI; 0.54–0.87)^[3].

So; this mini-review article designed to highlight the value of antenatal Magnesium Sulfate (MgSO₄) infusion before 34 gestational weeks in reduction of the cerebral palsy incidence associated with preterm labor (PTL), and low birth weight (LBW).

2. MATERIALS AND METHODS

A PubMed search done between 2002 to 2009 using the words; Mg Sulphate (MgSO₄), and fetal neuro-protection. The retrieved articles

were critically analyzed to highlight the value of antenatal Magnesium Sulfate (MgSO₄) infusion before 34 gestational weeks` in reduction of the cerebral palsy incidence associated with preterm labor (PTL), and low birth weight (LBW).

The exact mechanism of neuro-protection following antenatal MgSO₄ is not known but the following pathways have been suggested;

- a. MgSO₄ down regulates excitatory stimuli, by blocking N-methyl-D-aspartate receptor (NMDA) receptors in the brain ^[7-9].
- b. MgSO₄ improves the cerebral blood flow.
- c. MgSO₄ prevents cytokines involved in PTL from producing neuronal injury.
- d. MgSO₄ have an anti-apoptotic effect on the neuronal cells ^[7-9].

MgSO₄ achieve fetal neuro-protection, and indicated before 30 weeks` (<29+6 weeks) to women who are at imminent risk of PTL, or women with planned or definitely expected PTL within 24 hours or women in active PTL (MgSO₄ given 4 hours prior to delivery).

MgSO₄ for neuro-protection given for women at risk of PTL before 29+6 gestational weeks, irrespective their pregnancy is singleton or multiple, and irrespective corticosteroids given or not in the current pregnancy.

MgSO₄ infusion for neuro-protection of no value if given after 30 gestational weeks` or given for women not at risk PTL and/or LBW.

MgSO₄ regimen for fetal neuro-protection is 4 grams over 20 minutes (loading dose), followed by maintenance dose of 1 gram/hour for 4 hours.

Before MgSO₄ infusion;

- a) The PTL should confirmed using; trans-vaginal cervical length assessment (TVCL), and fetal fibronectin (fFN) test. The absence of fFN in the cervical secretions is very useful negative predictor of imminent PTL (negative predictive value for birth within 7 days is 97-98%).
- b) Confirm the gestational age using; early ultrasound scan done before 20 weeks` gestation, and first day of last menstrual (LMP) ^[10-12].
- c) Determine imminent labor; evidence of cervical effacement, and dilatation, ongoing contractions which are not relieved with tocolysis in women less than 30 gestational weeks`.

- d) MgSO₄ infusion given in the labor room, combined with the management of the PTL according to hospital protocol ^[3].
- e) The MgSO₄ infusion should combine with assessment of fetal and maternal wellbeing.
- f) Clinical care of the woman, and fetus according to the hospital protocol.
- g) The MgSO₄ infusion should started 4 hours before the anticipated delivery time.

The MgSO₄ infusion solution used is 8 grams of MgSO₄ in a 100 ml prepackaged solution given through infusion device (women only receive 50 ml = 4 grams of MgSO₄) ^[3,1].

Administer intravenous loading bolus dose of 4 grams of MgSO₄ over 20 minutes via a controlled infusion device (150 ml/hour for 20 minutes) ^[1].

The loading dose is followed by a maintenance infusion of 1 gram of MgSO₄ per hour for 4 hours (infusion rate of 12.5 ml per hour) ^[1].

Prior to the of MgSO₄ infusion ensure: presence of patellar reflexes, respiratory rate more than 12 /min, and correct medication, and infusion rate.

Calcium gluconate 1 gram in 10 ml (2.2 mmol calcium in 10 ml) must be available for treatment of MgSO₄ toxicity ^[1].

Patellar reflexes should check every 15 minutes for the first 2 hours of MgSO₄ infusion, then hourly. Stop the infusion, and collect blood for serum Magnesium levels if the patellar reflex absent at any time during the infusion.

Monitor the respiratory rate every 15 minutely during the first 2 hours of MgSO₄ infusion, then hourly. Stop the infusion, collect blood for serum Magnesium levels, maintain patent airway with Oxygen 6-8 liters/minute, followed by intravenous Calcium gluconate slowly, and monitor the heart rate with an ECG, if the respiratory rate was less than 12 per minute at any time during the infusion.

Monitor the Oxygen saturation levels hourly during the infusion. Stop the infusion, collect blood for serum Magnesium levels, call a code blue medical, and initiate respiratory support until the woman is intubated, and ventilated, in case of respiratory arrest during the infusion.

Measure and record urine output hourly during MgSO₄ infusion. Stop the infusion, collect blood for serum Magnesium levels, and call

medical staff, in case the urine output decreased during the infusion.

Monitor the blood pressure every 15 minutes during MgSO₄ infusion hourly, and report any side effects related to MgSO₄ infusion.

3. RESULTS

Conde-Agudelo et al, found that the MgSO₄ infusion to women at risk of labor before 34 gestational weeks` reduces the risk of CP, without any significant maternal side effects or complications ^[1]. In addition; Rouse et al, reported that the MgSO₄ reduced the risk of moderate or severe CP in infants of singleton pregnancies (RR 0.52, CI; 0.27–0.98) ^[2].

Recently; Doyle et al, meta-analysis reported that the antenatal MgSO₄ infusion before 37 gestational weeks` to women at risk of PTL associated with reduced CP risk (RR 0.68, CI; 0.54–0.87), and gross motor disabilities (RR 0.61, CI; 0.44–0.85) in their children without affecting the pediatric mortality (RR 1.04, CI; 0.92–1.17) ^[3].

4. DISCUSSION

Cerebral palsy has a prevalence of 2:1000 live births, and the principal obstetric risk factors for CP are PTL before 34 gestational weeks`, and LBW.

MgSO₄ administration to the preterm fetus has been linked with the prevention of CP since 1995.

Although; Crowther et al, found that the MgSO₄ had no a significant effect on the risk of CP in both infants of singleton pregnancies (RR 1.01, CI; 0.61–1.68), and infants of multiple gestations (RR 0.52, CI; 0.21–1.25) ^[13].

Conde-Agudelo et al, found in their systematic review, that the MgSO₄ infusion to women at risk of labor before 34 gestational weeks` reduces the risk of CP without any significant maternal side effects or complications (70% of women reported minor side effects including; flushing, pain at the injection site, and sweating) ^[1].

In addition; Rouse et al, reported that the MgSO₄ associated with reduction of moderate or severe CP in singleton pregnancies (RR 0.52, CI; 0.27–0.98) but not in twin pregnancy ^[2].

Recently; Doyle et al, meta-analysis reported that the antenatal MgSO₄ infusion before 37 gestational weeks` to women at risk of PTL associated with reduced CP risk (RR 0.68, CI;

0.54–0.87), and gross motor disabilities (RR 0.61, CI; 0.44–0.85) in their children without affecting the pediatric mortality (RR 1.04, CI; 0.92–1.17) ^[3].

In the Magpie trial, which concluded that the lower risk of eclampsia following prophylaxis with MgSO₄ was not associated with a clear decrease in the risk of death or disability for infants at 18 months ^[6], the time of MgSO₄ infusion was unclear, and the assessment of CP done at 18 months of age. However; preterm infants, have a lot of neurologic manifestations in the first months of age, which resolve later, and diagnosed wrongly as CP ^[1,14]. Therefore, it was suggested that the diagnosis of CP should assigned cautiously before 24 months of age unless the disorder is exceptionally severe ^[1,15].

No limitations were faced during conduction of this mini-review article. Future comparative studies needed to confirm the role of MgSO₄ in CP prevention in preterm infants, especially after increased incidence of multiple pregnancies, and PTL with the assisted artificial techniques (ARTs). This mini-review article concluded that the ante-natal MgSO₄ infusion before 34 gestational weeks` could be useful in in reduction of the cerebral palsy incidence associated with preterm labor (PTL), and low birth weight (LBW).

Conclusion: Ante-natal MgSO₄ infusion before 34 gestational weeks` could be useful in cerebral palsy prevention in preterm infants, without any significant maternal side effects or complications.

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