



The Effect of Magnesium Sulfate on Contraction of Pregnant Women with Cases of Partus Premature Imminent in District General Hospitals Mentawai Islands

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Abstract

In 2020, it was recorded that the number of neonatal deaths in West Sumatra was 104, with 18 cases being the cause of prematurity, where the Mentawai Islands district had the highest ranking of neonate deaths with 44 deaths and 10 cases being the cause of prematurity. This research aims to determine the effect of administering magnesium sulfate therapy on contractions of pregnant women in cases of imminent premature labour at the Mentawai Islands District Hospital in 2021. This type of research is pre-experimental with a *Grup Pretest-Post Test design* because in this study a random sample was not carried out by taking samples from secondary data retrospectively. Data taken came from medical records of inpatients who had a diagnosis of premature labour (ICD Total sampling was taken with a total sample size of 48, and statistical data analysis using the McNemar test. Data from 48 research subjects experienced contractions and received magnesium sulfate therapy. During monitoring after administering magnesium sulfate, 3 subjects still experienced contractions and 45 subjects did not experience contractions. Uterine contractions occurred significantly more before magnesium sulfate therapy than after magnesium sulfate therapy ($P < 0.005$). There is a significant relationship between administering magnesium sulfate to patients with preterm labour to stop uterine contractions at the Mentawai Islands District Hospital. Apart from being a tocolytic therapy, magnesium sulfate also has a neuroprotectant effect so it is highly recommended for therapy in cases of premature parturition.

Keywords: magnesium sulfate, premature labour, tocolytics

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Introduction

Premature birth is an important problem in the world of health (Prasad et al., 2023), especially in the field of obstetrics, because in both developing and developed countries the cause of neonatal morbidity and mortality is babies born preterm (Tissarinen et al., 2023). Babies born prematurely (before the 37th week of gestation) often experience very significant morbidity and need for a neonatal intensive care unit (Magee et al., 2019). Diagnosis of premature labour which will end in the birth of the baby is currently considered difficult (*inexact process*) in other words what differentiates "false" labour (*false lab*) and "original (*true labour*)" it turns out it's not easy (Cunningham et al., 2022). The diagnosis of preterm labour is generally based on the clinical criteria of regular uterine contractions (≥ 4 times every 20 minutes or ≥ 8 times in 60 minutes) accompanied by changes in cervical dilation (cervical dilation ≥ 3 cm or cervical length < 20 mm on transvaginal ultrasound, as well as the results laboratory positive *fetal fibronectin* (f FN +) (WHO, 2015) (ACOG, 2016).

Data released by WHO in 2018 showed that more than 60% of premature births occurred in countries in Africa and South Asia. In low-income countries, on average, 12% of babies are born prematurely (Miller et al., 2023). Meanwhile, in high-income countries, the average preterm birth rate is around 9%, usually the highest preterm births occur in poor families. Suman and Luther (2022), stated that premature birth occurs in around 9.5% of births throughout the world. Which equates to almost 13 million births. In the United States, the figure was around 11.4% in 2013. There was an increase in 2016 of 12.8% due to an increase in determining gestational age with ultrasound and an increase in the use of assisted reproductive technology. The incidence of preterm birth varies across states in the United States. In African Americans, the rate of preterm birth is nearly double compared to other racial/ethnic groups (ACOG, 2016).

Indonesia is reported to be ranked fifth in the country with the highest number of premature birth cases, namely 675/700 cases, and tenth in the country with the highest percentage of premature births out of every 100 live births (Manaf, 2023), namely around 15.5%. (WHO, 2018). Meanwhile, in 2021, *Maternal Perinatal Death Notification* The Indonesian Ministry of Health shows that the total neonatal death rate is 3554 with 1709 causes of prematurity (12.6%) (Indonesian Health Profile, 2021).

Data from the website *Maternal Perinatal Death Notification* In 2020, data from the Indonesian Ministry of Health for neonate deaths in West Sumatra Province recorded 104 cases with 18 cases of death due to prematurity (17.3%), while Mentawai Islands Regency was in first place for the highest number of neonate deaths in West Sumatra Province with the number of deaths. 44 cases with the cause of death due to prematurity were 10 cases of death (11.4%) Meanwhile in 2021 in West Sumatra Province it was reported that 237 cases of neonate death were recorded due to prematurity as many as 19 cases (8%) In the Mentawai Islands alone there were 37 reported deaths of neonates. due to prematurity in 6 cases (16%). (Indonesia Health Profile, 2020)

Complications in premature babies are associated with impaired neuronal development which results in impaired cognitive abilities, motor deficits, cerebral palsy, and visual and

hearing impairment. These risks will increase with the younger the gestational age. Behavioural disorders such as anxiety, depression, autism spectrum disorders, and ADHD (*Attention-Deficit Hyperactivity Disorder*) are also related to the consequences of premature birth (Vinstrup et al., 2023). Meanwhile, complications during the neonatal period include *necrotizing enterocolitis*, intraventricular haemorrhage, broncho pulmonary dysplasia retinopathy, growth disorders and the presence of congenital anomalies. (Suman and Luther, 2022) (Herman and Juwono, 2020).

From the description above regarding complications of premature birth which result in poor baby outcomes, it is necessary to prevent premature birth (Melchor Corcóstegui et al., 2023). One of the signs and symptoms of premature labour is regular uterine contractions. Uterine contractions are the most commonly recognized cause of premature birth (Laksmi, 2023). For this reason, cessation of uterine contractions has become a major focus of therapeutic intervention (Bear at All 2017). Many drugs have been used to inhibit myometrial contractions, including magnesium sulfate, calcium channel blockers, oxytocin antagonists, nonsteroidal anti-inflammatory drugs (NSAIDs), and beta-adrenergic receptor agonists. (Herman and Juwono, 2020) (Gáspár and Tóth, 2013)

Literature Review

Premature birth according to POGI (2019) and ACOG (2016) criteria is defined as birth between 20 weeks of gestation and 36 weeks of gestation. From this definition, it is further categorised into early and late prematurity. Early prematurity is when the baby is born before 33 weeks, and late prematurity is when the baby is born between 34 and 36 weeks (Suman and Luther, 2022). Meanwhile, the 2015 WHO classification classifies labour at 20-28 weeks as extreme prematurity (*extremely preterm*), 28-32 weeks as very preterm (*very preterm*) and from 32-37 weeks as late preterm (*moderate to late preterm*).

Preterm birth is responsible for three-quarters of cases of neonatal mortality and half of cases of neurological disorders in children. The risk of long-term nervous system development disorders and medical problems is high in children who are born. The younger the gestational age at birth is inversely proportional to the risk of neonatal morbidity and mortality (POGI 2019).

The diagnosis of premature labour can be made clinically, but this is not easy to do. Diagnosis is based on the presence of regular uterine contractions accompanied by flattening/*effacement* and/or cervical dilatation. In contrast to Braxton-Hicks contractions (false contractions), which often occur after 24 weeks of gestation, these are irregular uterine contractions and are not accompanied by changes in the cervix such as flattening/*effacement* and/or dilatation. However, digital examination of the cervix should be avoided if there is amniotic fluid leaking (*premature rupture of membrane*). Speculum and digital examinations are performed to assess cervical consistency, length and dilatation, which is ideally combined with cervical measurements using a transvaginal ultrasound examination. Transvaginal ultrasound examination to measure cervical length performed between 18 and 22 weeks of gestation can help identify patients at risk of preterm labour (Cunningham *et al.* 2022).

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A physical examination is performed to assess abdominal wall tension, fetal size, and position. Cervical examination to identify asymptomatic cervical dilatation and effacement/*effacement*. Symptoms of preterm labour include regular uterine contractions before term gestation associated with changes in the cervix, pressure in the pelvis, a sensation of menstrual cramps, increased vaginal secretions, and lower back pain. Although lower back pain can occur during term pregnancy, if it occurs before term pregnancy it is considered to be associated with a threat of preterm labour (POGI, 2019) (Herman and Juwono, 2020).

Research Method

This research was conducted to examine the tocolytic effect of magnesium sulfate therapy used in cases of premature labour. This type of research is pre-experimental with A *Grup Pretest-Post Test design* because in this study a random sample was not carried out by taking samples from secondary data retrospectively. This research was carried out in the Mentawai District General Hospital Medical Records Department from August to September 2022. The research sample was all pregnant women treated in the Obstetrics section of the Mentawai Islands District Hospital with a diagnosis of premature parturition. Samples were taken using a total population technique of 48 samples. The independent variable of MgSO₄ administration, as well as the dependent variable, namely uterine contractions, are categorical data and then One Group Pre-Post Test analysis is carried out using the Mc Nemar statistical test (Dahlan 2010).

Result

1. Univariate analysis

a. Frequency Distribution of Patients Based on the assessment of uterine contractions before being given magnesium sulfate therapy at the Mentawai Islands District Hospital in 2021

Frequency Distribution of Patients Based on the assessment of uterine contractions before being given magnesium sulfate therapy at the Mentawai Islands District Hospital in 2021

No	Contraction Criteria	N	%
1	There are contractions	48	100
2	No Contractions	0	0
Total		48	100

Based on Table 4.1, It can be seen that all patients with premature labour before receiving magnesium sulfate therapy had uterine contractions,

namely 48 patients or 100%.

b. Frequency Distribution of Patients Based on uterine contraction assessment after being given magnesium sulfate therapy at the Mentawai Islands District Hospital in 2021

Frequency Distribution of Patients Based on uterine contraction assessment after being given magnesium sulfate therapy at the Mentawai Islands District Hospital in 2021

No	Contraction Criteria	N	%
1	There are contractions	3	6,2
2	No Contractions	45	93,8
Total		48	100

Based on Table 4.2, it can be seen that the number of patients whose contractions disappeared after receiving magnesium sulfate therapy was 45 patients. The majority of patients who experienced a decrease or disappearance of contractions after magnesium sulfate therapy were 93.8% of patients and there were still contractions in 3 patients or 6.2%.

2. Bivariate Analysis

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	After Magnesium sulfate therapy		Total	P value (*)	
	There are contraction s	No Contractions			
Before magnesium sulfate therapy	There are contractions	3 (6,2%)	45 (93,8%)	48 (100%)	0,000
	No contractions	0	0	0	
total		3 (6,2%)	45 (93,8%)	48 (100%)	

(*) : *Mc Namer test with SPSS*

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Based on Table 4.3, it can be seen that out of a total of 48 pregnant women with PPI before receiving magnesium sulfate therapy, 48 (100%) experienced contractions, after administering magnesium sulfate therapy, uterine contractions were monitored and 45 (93.8%) were found.) mothers whose contractions disappeared or had no contractions, while 3 (6.2%) pregnant women with PPI continued to experience contractions. Based on the results of statistical tests using Mc Nemar in Table 4.4, it shows that the p-value is 0.000 ($\alpha \leq 0.05$). This shows that there is a significant change between the independent variable (Magnesium Sulfate) and the dependent variable (Uterine contractions in pregnant women with PPI) at the Mentawai Islands District Regional Hospital in 2021

Discussion

1. Univariate Analysis

Based on univariate data analysis, data was obtained that 48 people or 100% of pregnant women with Partus Prematurus Imminens experienced uterine contractions. This is by the theory regarding cases of premature parturition where one of the main symptoms of premature parturition is the presence of regular and persistent uterine contractions.

At the beginning of pregnancy, the myometrium muscle begins to contract irregularly, which the pregnant woman perceives as a mild cramping sensation in the lower abdomen. As gestational age increases, uterine contractions sometimes appear but do not produce changes in the lower uterine segment and changes in the cervix which are usually called false contractions or Braxton Hicks. (Cunningham *at all*, 2022) (Bear *at all* 2017).

Clinically, uterine contractions can begin to be felt if the contraction intensity exceeds 10 mmHg. Up to an intensity of up to 40 mmHg the uterine wall can still bend if pressed with a finger. The stronger the intensity of the contractions, the harder the uterine wall becomes and the harder it is to press with a finger. Painful sensations such as cramps usually occur if the intensity of uterine contractions exceeds 15mmHg, this is due to the minimum intensity required to stretch the lower uterine segment (Cunningham *at all*, 2022).

Another criterion proposed by the *American College of Obstetricians and Gynecologists* (2016) as with the POGI criteria (2019) contractions associated with premature labour are contractions that occur with a frequency of four times in 20 minutes or eight times in 60 minutes with progressive changes in the cervix when the examination is carried out there is cervical dilatation of more than 1 cm or cervical effacement of 80% or more.

2. Bivariate Analysis

Based on bivariate analysis, the results showed that after receiving magnesium sulfate therapy according to the dose, 45 patients (93.8%) with cases of premature labour had no or lost contractions and there were 3 patients (6.2%) with cases of premature labour

who continued to experience contractions after receiving magnesium sulfate therapy (Arab et al., 2023).

In this study, the administration of magnesium sulfate tocolytics (Zhao et al., 2023) can temporarily stop contractions so that the fetus may be born after the administration of magnesium sulfate tocolytics is completed (Peng et al., 2023). The older the gestational age, the more frequently birth occurs even though tocolytic therapy has been given (Mega et al., 2023). So it is not recommended to administer maintenance tocolytics after more than 48 hours (ACOG 2016).

Based on bivariate analysis with the MC Nemar statistical test, it was found that the p-value was 0.000 (p value $< (0.05)$), so H_0 was rejected and H_1 was accepted, meaning that it could be stated that there was a significant difference between uterine contractions of pregnant women and cases of imminent premature parturition before birth. give magnesium sulfate therapy (Pratt et al., 2023) with PPI pregnant women's contractions after being given magnesium sulfate at the Mentawai Islands District Hospital in 2021.

Lyell's research, (2007) compared the effectiveness of magnesium sulfate tocolytic therapy compared with nifedipine. This research was carried out in a multicenter randomized trial, on patients who experienced preterm labour with a gestational age of 24-33 weeks. The results of this study show that the magnesium sulfate group achieved more of the primary outcome in the form of cessation of preterm labour (Abd El-Aziz et al., 2023), which is characterized by the birth of the baby within 48 hours and the uterine contractions disappearing (Omori-Shimano et al., 2023).

Research from Arrowsmith at *All* (2016) regarding the muscle relaxing effect of magnesium sulfate on myometrial muscles obtained from the uterus of pregnant women with single fetuses and Gemelli carried out in vitro, results showed that magnesium sulfate could prevent myometrial contractions. Meanwhile, administration of oxytocin can reduce the tocolytic effect of magnesium sulfate. So the failure of the tocolytic effect to maintain pregnancy within 48 hours will be greater in the advanced labour process which is characterised by increased frequency and intensity of contractions due to the production of oxytocin in the body which is already quite large (Vanhaesebrouck et al., 2023), thereby inhibiting the tocolytic effect of magnesium sulfate.

Conclusion

Almost all or 100% of pregnant women with cases of premature labour who have not received Magnesium Sulfate therapy experience contractions. In the majority, or almost 93.2%, of pregnant women with cases of imminent premature labour after receiving magnesium sulfate therapy, their contractions disappeared or did not exist. It was concluded that there was a significant relationship between contractions of pregnant women and cases of premature labour and the provision of magnesium sulfate therapy in the work area of the Mentawai Islands District Hospital in 2021.

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References

- Abd El-Aziz, R. A. E. R., Asal, M. F., & Maaly, A. M. (2023). Effectiveness of adding magnesium sulfate to bupivacaine in ultrasound guided serratus anterior plane block in patients undergoing modified radical mastectomy. *Egyptian Journal of Anaesthesia*, 39(1). <https://doi.org/10.1080/11101849.2023.2168856>
- American College of Obstetricians and Gynecologists (ACOG) 2016, Management of preterm labour, Practice Bulletin No. 159. *Obstet Gynecol*; 127:e29–38. https://journals.lww.com/greenjournal/Fulltext/2016/01000/Practice_Bulletin_No159_Management_of_Preterm.51.aspx
- Arab, H. H., Khames, A., Alsufyani, S. E., El-Sheikh, A. A. K., & Gad, A. M. (2023). Targeting the Endoplasmic Reticulum Stress-Linked PERK/GRP78/CHOP Pathway with Magnesium Sulfate Attenuates Chronic-Restraint-Stress-Induced Depression-like Neuropathology in Rats. *Pharmaceuticals*, 16(2). <https://doi.org/10.3390/ph16020300>
- Arrowsmith S, Neilson J, Wray S, 2016 The combination tocolytic effect of magnesium sulfate and an oxytocin receptor antagonist in myometrium from singleton and twin pregnancies, *American Journal of Obstetrics and Gynecology*, Volume 215, Issue 6, Pages 789.e1-789.e9, <https://doi.org/10.1016/j.ajog.2016.08.015>
- Bear M, Bonnheim M, Gallardo C, Kruse, CM, Landers K, Lanzoni A, Lizardi R, Luckett M, Piacenza D, Psaros K, Rena G, Simpson C, Sundlie B, Wilsker D, 2017, *Nursing Key Topics Review: Maternity*, Elsevier, Inc, Missouri
- Cunningham FG, Leveno KJ, Dashe JS, Hoffman BL, Spong CY, Casey BM, 2022, *Williams Obstetrics*, 26th ed, Mc Graw Hill, New York.
- Dahlan MS, 2010, *Statistics For Medicine And Health*, Salemba Medika, Jakarta
- Gáspár, R and Tóth, JH 2013, Calcium Channel Blockers as Tocolytics: Principles of Their Actions, Adverse Effects and Therapeutic Combinations, *Pharmaceuticals*, 6,689-699, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3816733/pdf/pharmaceuticals-06-00689.pdf>
- Herman S, Santoso B, Joewono HT, Sulistyono A, Basuki H, Miftahussurur M, 2020, Risk Factors as an Indicator of Non-Complications Spontaneous Preterm Birth: a Study in Eight Hospitals. *Journal of International Dental and Medical Research*. 13(1):395-399. <https://scholar.unair.ac.id/en/publications/risk-factors-as-an-indicator-of-non-complications-spontaneous-pre>
- Indonesian Ministry of Health. Indonesia Health Profile 2020. Jakarta: Ministry of Health; 2020.
- Indonesian Ministry of Health. Indonesia Health Profile 2021. Jakarta: Ministry of Health; 2021.
- Laksmi, N. P. C. (2023). Relationship between Husband's Social Support and Participation in Pregnant Women Class in Denpasar City in 2019. *Journal of Health Science and Medical Therapy*, 2(01), 63–69. <https://doi.org/10.59653/jhsmt.v2i01.444>
- Lyell, D J, Pullen, K, Campbell, L, Ching, S, Druzin, ML, Chitkara, U, Burrs, D, Caughey, A B, El-Sayed, Yasser Y, Magnesium Sulfate Compared With Nifedipine for Acute Tocolysis of Preterm Labor: A Randomized Controlled Trial. *Obstetrics &*

Gynecology: July 2007 - Volume 110 - Issue 1 - p 61-67
doi:10.1097/01.AOG.0000269048.06634.35

- Magee L, Sawchuck D, Synnes A, Dadelszen P: Magnesium Sulfate for Fetal Neuroprotection, *SOGC CLINICAL PRACTICE GUIDELINE*| VOLUME 41, ISSUE 4, P505-522, APRIL 01, 2019 No. 376 [https://www.jogc.com/article/S1701-2163\(18\)30760-6/fulltext](https://www.jogc.com/article/S1701-2163(18)30760-6/fulltext)
- Manaf, N. (2023). Guiding the Behavior of Young Women in Family Planning and Prevention of Anemia through Peer Group Empowerment as an Effort to Prevent Stunting. *Journal of Health Science and Medical Therapy*, 1(01), 21–29. <https://doi.org/10.59653/jhsmt.v1i01.143>
- Mega, T. A., Gugsa, H., Dejenie, H., Hussen, H., & Lulseged, K. (2023). Safety and Effectiveness of Magnesium Sulphate for Severe Acute Asthma Management Among Under-five Children: Systematic Review and Meta-analysis. In *Journal of Asthma and Allergy* (Vol. 16). <https://doi.org/10.2147/JAA.S390389>
- Melchor Corcóstegui, I., Unibaso Rodríguez, E., Ruiz Blanco, N., Nikolova, T., Nikolova, N., Burgos San Cristóbal, J., & Melchor Marcos, J. C. (2023). Is mid-trimester cervical length screening effective for reduction of threatened preterm labor? *Taiwanese Journal of Obstetrics and Gynecology*, 62(3). <https://doi.org/10.1016/j.tjog.2022.09.014>
- Miller, F. A., Sacco, A., David, A. L., & Boyle, A. K. (2023). Interventions for Infection and Inflammation-Induced Preterm Birth: a Preclinical Systematic Review. In *Reproductive Sciences* (Vol. 30, Issue 2). <https://doi.org/10.1007/s43032-022-00934-x>
- Omori-Shimano, S., Tominaga, T., & Ikeda, K. (2023). Maternal magnesium sulfate administration increases early-onset hyperkalemia risk in premature infants: A propensity score-matched, case-control study. *Pediatrics and Neonatology*, 64(2). <https://doi.org/10.1016/j.pedneo.2022.06.011>
- Peng, Q., Yang, X., Li, J., You, Y., & Zhao, X. chun. (2023). The Effect of the Magnesium Sulfate in Ultrasound-Guided Quadratus Lumborum Block on Postoperative Analgesia: A Randomized Controlled Trial. *Pain and Therapy*, 12(1). <https://doi.org/10.1007/s40122-022-00436-3>
- POGI 2019, *Preterm Labor Guide*, Central Executive of the Indonesian Obstetrics and Gynecology Association, Jakarta
- Prasad, P., Romero, R., Chaiworapongsa, T., Gomez-Lopez, N., Lo, A., Galaz, J., Taran, A. B., Jung, E., Gotsch, F., Than, N. G., & Tarca, A. L. (2023). Further Evidence that an Episode of Premature Labor Is a Pathologic State: Involvement of the Insulin-Like Growth Factor System. *Fetal Diagnosis and Therapy*, 50(4). <https://doi.org/10.1159/000530862>
- Pratt, S. L., Bowen, M., & Redpath, A. (2023). Resolution of sustained ventricular tachycardia in a horse presenting with colic with magnesium sulfate. *Equine Veterinary Education*, 35(8). <https://doi.org/10.1111/eve.13775>
- Suman, V and Luther, E 2022, *Preterm Labor.*, StatPearls Publishing, <https://www.ncbi.nlm.nih.gov/books/NBK536939/#article-27706.s1>
- Tissarinen, P., Tiensuu, H., Haapalainen, A. M., Määttä, T. A., Ojaniemi, M., Hallman, M., & Rämetsä, M. (2023). Elevated human placental heat shock protein 5 is associated with

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spontaneous preterm birth. *Pediatric Research*, 94(2). <https://doi.org/10.1038/s41390-023-02501-9>

Vanhaesebrouck, S., Zecic, A., Goossens, L., Keymeulen, A., Garabedian, L., De Meulemeester, J., Naessens, P., De Coen, K., & Smets, K. (2023). Association of antenatal magnesium sulfate with reduced late-onset sepsis in extreme preterm infants. *Acta Clinica Belgica: International Journal of Clinical and Laboratory Medicine*, 78(1). <https://doi.org/10.1080/17843286.2022.2048531>

Vinstrup, J., Bláfoss, R., López-Bueno, R., Calatayud, J., Villadsen, E., Clausen, T., Doménech-García, V., & Andersen, L. L. (2023). Pain Control Beliefs Predict Premature Withdrawal From the Labor Market in Workers With Persistent Pain: Prospective Cohort Study With 11-Year Register Follow-up. *Journal of Pain*, 24(10). <https://doi.org/10.1016/j.jpain.2023.05.009>

WHO, 2015. WHO Recommendations On Interventions To Improve Preterm Birth, WHO Press, Geneva

WHO 2018, *Fact Sheet Preterm Birth*, <https://www.who.int/news-room/fact-sheets/detail/preterm-birth>

Zhao, C., Wang, L., Chen, L., Wang, Q., & Kang, P. (2023). Effects of magnesium sulfate on periarticular infiltration analgesia in total knee arthroplasty: a prospective, double-blind, randomized controlled trial. *Journal of Orthopaedic Surgery and Research*, 18(1). <https://doi.org/10.1186/s13018-023-03790-w>