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**Evaluation the effect of Magnesium levels as a means of preventing Atrial
Fibrillation**

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Abstract:

Magnesium is one of the most important minerals for the function and health of the body's systems, and it plays a role in regulating the heartbeat. Magnesium deficiency can cause damage to heart health, and atrial fibrillation, which increases the chance of strokes / heart failure. The aim was to evaluate the effect of a specific level of magnesium as a means of protection against atrial fibrillation. The researcher has used the Randomized Control Studies - Meta-analysis. As a result of an analysis of fifteen trials (1769 patients), it was concluded that magnesium intake can contribute to a 23% reduction in the risk of supraventricular arrhythmias, and a reduction in the incidence of atrial fibrillation by 29% and 48%. Reduce the risk of developing atrial fibrillation. Ventricular tachycardia (after heart surgery). As a result of the analysis, magnesium can reduce the risk of ventricular arrhythmias by 32% and 42% of the risk of supraventricular arrhythmias. This study has demonstrated in the group receiving magnesium sulfate, the overall rate of arrhythmias was lower compared to placebo. Compared to placebo, magnesium consumption reduces ventricular and supraventricular arrhythmias.

Key words: *Magnesium, Atrial Fibrillation, Atrial Flutter, Heart palpitations*



Introduction:

Magnesium is one of the most important minerals for the function and health of the body's systems, and its deficiency is caused by serious problems and symptoms, including shortness of breath / chest pain / fainting, heart rhythm disturbances, which are often mild but in heart palpitations and temporary interruptions between beats . It helps to stimulate blood circulation, and works to strengthen the muscles of the body, including the "heart muscle" (Mohammadzadeh, 2017).

It is possible from the chances of death from heart attacks and strokes, as it plays a role in regulating the heartbeat (Mhaskar, 2013). According to studies, magnesium deficiency can cause damage to heart health, and atrial fibrillation, which increases the chance of strokes / heart failure.

The importance of studying:

The study takes its importance because it studies the most important element for the health of the body, which is magnesium, especially on the health of the heart, as it is one of the most important muscles of the body and responsible for human life, in order to be able to benefit from the impact of this element in maintaining heart health and mitigating the impact of atrial fibrillation.

Study questions:

Under this study there is a main heading:

- What is the effect of "magnesium level" on heart health "in the prevention of atrial fibrillation"?

Study opportunities:

The study was based on the assumption that there is a positive effect of “magnesium administration” in reducing and preventing the occurrence of “atrial fibrillation”.



Theoretical Framework

1- Atrial fibrillation and Atrial Flutter

It is a type of electrical discharge that causes the atria to contract rapidly, with electrical impulses reaching the ventricles, where they contract faster and less efficiently than they are working. Enlarged atria are the cause of these disorders. There are also some symptoms that indicate a rapid ventricular contraction: palpitations - general weakness - dizziness - shortness of breath - chest pain (Fuller, 1989).

Diagnosis is confirmed by electrocardiogram. Atrial fibrillation/atrial flutter is more common in the elderly and those with a heart disorder. And cases of atrial fibrillation seen more than atrial flutter. Atrial flutter patients suffer from episodes of atrial fibrillation most often. Both can occur intermittently/continuously (Leitch, 1990).

In atrial fibrillation, electrical impulses occur in and around areas of the atria (not in one area). And electrical activity in this case is turbulent (irregular), here the walls of the atria tremble (instead of contracting). They don't help pump blood into the ventricles, thus the amount of blood that is pumped to the heart is reduced by up to 10%. Therefore, the ventricles beat irregularly. In most (untreated) patients with atrial fibrillation, the heartbeat reaches the ventricles at a faster-than-normal rate (140-160/min, as a normal heart rate is 60-100/min). (The rate may be much higher during exercise (Creswell, 1993).

During atrial flutter, the electrical activity in the atria is coordinated, unlike atrial fibrillation. Thus, the atrium is contracting at a very fast rate (250 - 350/min). The rate is too fast to allow each heartbeat to be delivered to the ventricles. Through the AV node. For most untreated patients, one atrial beat reaches the ventricles every second, resulting in a ventricular rate of about 150 beats per minute (Mathew, 1996).



1-1 Causes of atrial fibrillation

Atrial fibrillation/atrial flutter may occur in the absence of a heart disorder. Heart arrhythmias are often caused by (Olshansky, 1996):

- Hypertension
- heart disease (coronary)
- Heart valve disorders affecting the mitral valve - tricuspid valve
- alcoholism
- Excessive thyroid activity
- Having a congenital heart defect

1-2 Complications of atrial fibrillation

The main complications include (Almassi, 1997):

- Blood clots in the atria
- A fast heart rate, causing a decrease in heart output

In atrial fibrillation or atrial flutter, atrial discharge into the ventricles does not occur with each beat. Over time, some blood may stagnate within the atria, so blood clots (thrombus) can form. Often pieces of clot break off soon after the fibrillation returns. The atria may return to normal—either spontaneously or because of treatment. These pieces of clots may travel from the clots to the left ventricle and then travel in the body through the bloodstream (become emboli), blocking smaller arteries. If clots block an artery in the brain, a stroke can occur. In rare cases, a stroke can be the first sign of atrial fibrillation or atrial flutter (Ommen, 1997).

When a rapid heartbeat occurs as a result of atrial fibrillation/atrial flutter, then there is not enough time for the ventricles to completely fill with blood. Here, the heart pumps less blood because the linings are not completely filled. This can cause low blood pressure or heart failure (Hogue, 2000).



1-3 Symptoms

If the ventricular rate is too fast, the reduced ability of the heart to pump blood can lead to weakness, fatigue, and shortness of breath. Some patients, especially the elderly and those with cardiac disorders, develop heart failure or chest pain. In very rare cases, some of these patients may go into shock (extremely low blood pressure) (Hogue, 2000).

2- The Magnesium

Magnesium plays a role in the functioning and function of the heart. It helps in the formation of bones and teeth, and it also plays a role in the functioning of organs throughout the body, such as (kidneys and muscles) (Khan, 1973). On the other hand, large amounts of magnesium can cause symptoms including irregular heartbeat (flutter), - rapid heartbeat (palpitations) (Tabari et al, 2009).

Magnesium is an element naturally present in a number of foods (spinach - soybeans - potatoes - almonds - avocados - lentils), and it is manufactured as supplements such as: carbonate - oxide - chloride - lactate - magnesium citrate. As these products contain different amounts of magnesium, the ability of your body to absorb and use the supplement depends on the form you consume) (Mhaskar et al, 2013).

Magnesium is one of the most versatile dietary minerals, and is essential for many parts of the body such as tissues and muscles, but the most important of all, the heart. Magnesium helps complete 300 chemical reactions, such as metabolism and production of nucleic acids and protein, and maintains a healthy heart (Kinnunen, 1987). And the best levels of magnesium are maintained healthy in the body, while eating natural organic foods, and reducing the amounts of sugar and salt, according to the “foodworldblog” blog, which specializes in nutrition and as quoted by Sky News (Moeen et al, 2010).



3- Heart palpitations and magnesium

In most cases, heart palpitations are medically harmless. Conversely, palpitations can indicate heart problems (arrhythmia - unusually fast/slow heartbeat) (Kelepouris & Agus, 1998). Especially when symptoms such as: fainting - chest pain - insomnia or shortness of breath - dizziness. A complication that appears after heart surgery (atrial fibrillation). At a rate of 25-40%. Where its occurrence is associated with (Abbas et al, 2015):

- High rates of stroke
- Impaired heart function
- Adverse effects of medications used to prevent atrial fibrillation

A common occurrence of hypomagnesaemia has been found after coronary artery bypass grafting (CABG) and other types of heart surgery. Some clinical trials have measured the effectiveness of magnesium as an intervention method for reducing the incidence of postoperative atrial fibrillation (Aglione et al., 1991).



Practical Framework

METHODS Study Criteria

According to the criteria:

- Random Set
- Use of a placebo
- Presence of a magnesium management protocol
- Sufficient data on the effectiveness of treatment (the occurrence of supraventricular arrhythmias)
- Primary prevention of atrial fibrillation after coronary artery bypass grafting or valve surgery
- Start treatment immediately before or after surgery
- There is no confusion between treatment and random drugs

Data collection and analysis

The data were extracted independently in a compilation table prepared for the study.

- The number
- Properties
- Medicines used
- Type and method of intervention
- A case of atrial fibrillation or supraventricular arrhythmia
- state of appetite
- The occurrence of clots

Data Extraction:

Basic data were collected from (participants - interventions - results) for analysis.

Study information, magnesium dosage, incidence and types of supraventricular and supraventricular arrhythmias.

All included trials were independently evaluated and data were extracted (standard extraction). Excel data analysis was used.

Statistical Analysis

The occurrence of arrhythmia will be evaluated. Using the binomial distribution, the variance in each study and the weighted average will be calculated. As weight in each study is proportional to the inverse of variance. CI 95% (OR) 95%.

Table 1: General studies - meta-analysis

	study		Clinical settings	number		Mean Age		Treatment Mg SO4 over \ h
				Mg	P	Mg	P	
1	Shechter.M	1990	Not surgery	50	53	64 ± 10	63 ± 11	22 g / 24 h
2	M.Thiigersen .A	1993	Not surgery	54	55	67 ± 10	67 ± 11	50 mmol /20 h
3	Bhargava.B	1995	Not surgery	40	38	58 ± 10	56 ± 8	65 mmol /24 h
4	Karmy- Jones.R	1995	CABG	46	54	64.5 ± 7.9	60.2 ± 11.9	2.4 g /24 h
5	Shakerinia.T	1996	CABG	25	25	67.2 ± 8.3	64.9 ± 6.7	15 mmol/L /24 h
6	Raghu.C	1999	Not surgery	169	181	52.9 ± 11	53.1 ± 10.8	18 g /24 h
7	Parikka.H	1999	Not surgery	31	26	60 ± 6	59 ± 6	70 mmol /24 h

8	Treggiari-Venzi MM	2000		CABG	47	51	65	65	4 g /24 h
9	Toraman F	2001		CABG	100	100	62 ± 6.7	61.4 ± 8.7	0.8 g /24 h
10	Ebadi.A	2008		CABG	81	81	61.6 ± 5.5	61.7 ± 8.5	2 g /24 h
11	Cook RC	2009		CABG	462	465	–	–	5 g /24 h
12	Tabari.M	2009		CABG	60	60	61.3 ± 0.6	58.4 ± 10.3	4.5 g /24 h
13	Mhaskar DM	2013		Not surgery	50	50	59.1 ± 13.4	59.5 ± 15.03	20 g /24 h
14	Abbas SH	2015		CABG	130	130	51.7 ± 10.2	51.7 ± 10.2	1 g v 24 h
15	Mohammadzadeh A	2017		CABG	125	125	60.8 ± 7.6	61.3 ± 6.6	30 mg/kg /in 5 min
Notes: Mg, magnesium; P, placebo; CABG, coronary artery bypass grafting									

Table 2: Using a random-effect meta-analysis—arrhythmia

	Type of arrhythmia	Treatment	Number of studies	Prevalence %	Confidence interval 95% (CI%95)	Heterogeneity index I2 (%)	P value
1	Ventricular Tachycardia	Mg	7	5.55	1.35–11.89	71.81	0.003
2		Placebo	7	14.9	6.39–26.10	88.9	0
3	Ventricular Fibrillation	Mg	7	2.10	0.00–6.62	76.81	0
4		Placebo	7	4.39	0.35–11.80	86.09	0
5	Total ventricular arrhythmia	Mg	13	11.9 1	6.75–18.14	82.99	0
6		Placebo	13	24.2 6	14.50–35.42	92.11	0
7	Atrial Fibrillation	Mg	9	9.72	3.31–18.63	92.15	0
8		Placebo	9	22.3 7	15.86–29.59	85.3	0
9	Supraventricular Tachycardia	Mg	6	4.9	0.84–11.28	75.36	0
10		Placebo	6	14.6 2	7.26–23.82	78.76	0
11	Total supraventricular arrhythmia	Mg	14	10.3 6	5.55–16.32	87.16	0
12		Placebo	14	23.9 1	18.82–29.38	75.1	0
13	Bradycardia	Mg	4	6.46	0.71–12.21	78.9	0
14		Placebo	4	7.2	1.03–1.37	79.8	0

1 5	Total arrhythmia	Mg	22	41	11.44–21.0	85.89	0
1 6		Placebo	22	30.8 5	25.07–39.63	86.21	0

Table 3: Magnesium Cardiac arrhythmias ↔ placebo

Type of Arrhythmia	Summary odds ratio (OR)	95% confidence interval	Between studies	
			I ²	p for heterogeneity
Ventricular tachycardia	0.66	0.52–0.86	0.556	0.036
Ventricular fibrillation	0.69	0.49–1.02	0.498	0.098
Total of Ventricular arrhythmia	0.38	0.23–0.64	0.79	0
Atrial Fibrillation	0.46	0.28–0.76	0.769	0
Supraventricular tachycardia	0.48	0.33–0.70	0.485	0.084
Total of Supraventricular arrhythmia	0.43	0.28–0.65	0.734	0
Bradycardia	1.29	0.99–1.69	12.7	0.329
Total Arrhythmia	0.41	0.29–0.58	82.1	0



Table 2 shows the result of data analysis of arrhythmia rates. Average incidence of ventricular tachycardia (magnesium sulfate vs. placebo) 95% CL:

- 5.55 % / 1.35 – 11.89 /
- 14.9 % / 6.39 – 26.10 /

Prevalence of ventricular fibrillation (magnesium sulfate group):

- 2.10 % / 0.00 - 6.62 /
- 4.39 % / 0.35 – 11.80 /

The overall rate of ventricular arrhythmia was:

- 11.91 % / 6.75 – 18.14 /
- 24.26 % / 14.50 – 35.42 /

Table 3 shows the analysis:

Magnesium group compared to placebo: no difference in ventricular fibrillation

- OR = 0.69, 0.49 – 1.02 ; I₂ = 4.98%, P = 0.089

But a significant reduction in ventricular tachycardia was observed between the magnesium and placebo groups:

- OR = 0.66, 0.52 – 0.86 ; I₂ = 55.6%, P = 0.036

This analysis - using a random-effects model - showed that magnesium can reduce ventricular arrhythmias compared with placebo

- OR = 0.32, 0.29 - 0.58; P < 0.001 .

There was heterogeneity between trials I₂ = 69.6%; P = 0.000.



Discussion

We analyzed studies on the effect of magnesium consumption on alleviating hyperarrhythmics, comparing the use of a placebo to giving patients magnesium sulfate. The result was a positive association between the administration of magnesium sulfate and the alleviation of arrhythmia..

The result of a meta-analysis of 8 trials showed an improvement in 530 patients as a result of receiving magnesium in contributing to the prevention of arrhythmia. In the case of acute myocardial infarction, the result was a decrease in ventricular arrhythmias by 49% and a decrease of 54% in cases of supraventricular tachycardia.

Despite the above, a significant effect of magnesium has not been investigated with "supraventricular" arrhythmias.

For atrial fibrillation: According to the analysis of 2595 patients, an association was found between intravenous administration of magnesium and a significant decrease in the incidence of high heart rate in patients with coronary artery bypass surgery.

Results of a study of 20 randomized trials of 2050 patients:

Magnesium is considered a precautionary measure after surgery for atrial fibrillation. The percentage of its contribution to reducing the occurrence of atrial fibrillation reached 36%. The result of the analysis was consistent with the results of previous studies; Magnesium intake can be beneficial in the prevention, protection, and treatment of various heart rhythm disorders.

Magnesium is a cofactor of the Na-K transmembrane pump. It acts as an exogenous regulator of K^+ . As a result, in the absence of Mg^{2+} potassium moves equally in both directions, it plays an important role in many biological processes of the body.

Magnesium deficiency can cause decreased efficiency of both the intracellular pump and potassium, resulting in partial membrane depolarization as well as changes in the activity of several of its potentially related channels. And thus leads to disruption of the membrane



behind the heart cells and as a result, arrhythmia occurs. In cases of patients with cardiovascular diseases, we find a common deficiency of magnesium in the blood.

In supraventricular and ventricular arrhythmias, magnesium deficiency is an important factor. In cases of congestive heart failure, arrhythmias, premature ventricular beats and atrial fibrillation. We found 55% of hypomagnesemia cases.

Serum magnesium levels should be monitored in patients with heart disease and others. Through periodic examinations and work to correct magnesium levels in the blood.

Conclusion

Through the results of the study, the following was concluded:

- The overall rate of arrhythmias in the group that received magnesium sulfate was significantly lower than the placebo.
- Magnesium consumption compared to placebo reduces ventricular and supraventricular arrhythmias.

Recommendations:

Through the results obtained, the researcher recommends the following:

- Cost-effective management of magnesium sulfate can be safe and effective in preventing the occurrence of arrhythmias.
- Checking the level of magnesium in the blood and working to correct it, may contribute to treating irregular heartbeat and improving the health of heart patients.
- Many researches and studies must be conducted with regard to taking magnesium sulfate supplement doses and the appropriate timing for that to prove the effectiveness of this method in atrial disorder.



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