# THE ORAL DEXAMETHASONE EFFECTIVENESS IN REDUCING GASTROINTESTINAL AND NEUROLOGICAL SIDE EFFECTS OF METRIZAMIDE LUMBAR MYELOGRAPHY: A DOUBLE-BLIND, PLACEBO-CONTROLLED STUDY

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**Abstract**

**Background:** One of the most popular contrast agents is metrizamide which is also nonionic and the reason behind its high application in lumbar myelography is because of its high diagnostic quality as compared to the older contrast agents such as Pantopaque. But it has a range of side effects, especially gastrointestinal in nature, nausea, vomiting, headaches and others. Previous research has indicated that these side effects can be decreased by steroid treatments. The study was conducted to determine the effectiveness of oral dexamethasone in the management of gastrointestinal and other adverse effects that are prevalent with metrizamide lumbar myelography. **Methods:** It was a double-blinded placebo-controlled study together with 145 adult patients with either chronic low back and/or leg pain and underwent lumbar metrizamide myelography. At intervals, the participants were randomly grouped into dexamethasone (4 mg) and placebo before and after the procedure. The severity of the symptoms was evaluated by the use of a 24-item symptom checklist prior to the procedure and 24 hours post-procedure. Chi-square tests, correlation coefficients, and post hoc tests were the methods used to analyze the data to determine the relationship between treatment and changes in the symptoms. **Results:** The findings demonstrated that there was a statistically significant decrease in vomiting symptoms in the dexamethasone group whereby 10.5% patients in the placebo group reported increased vomiting symptoms as compared to 0 in the dexamethasone group (2 -test = 4.48, p = 0.034). The difference in other symptoms like headache and nausea was not statistically significant although there was a reduction. Pain in the legs and weakness in legs or feet were also significantly improved in the dexamethasone group, also not significantly. The results of the analysis also indicated a positive relationship between nausea and the scores on MMPI hysteria in the group of dexamethasone. **Conclusion:** In patients who underwent metrizamide lumbar myelography, oral dexamethasone was effective in the reduction of some gastrointestinal side effects especially vomiting. Even though the drug failed to alleviate all the side effects, its protective effects were specifically noticeable in the elderly patients. Personality traits also were recognized as having an impact on reporting of nausea and other symptoms in the study.

**Key Words:** Dexamethasone, Metrizamide, Lumbar Myelography

## Introduction

The development of the nonionic metrizamide in more than ten years ago was a significant advancement in the sphere of myelography. Arachnoiditis is not seen in human cases whereas its frightening side effect of up to 67 percent was reported in patients with Pantopaque studies [1]. Also, lumbar myelograms with metrizamide are much higher in quality than those with Pantopaque and hence metrizamide is the choice of contrast agent with lumbar myelography, until the recent introduction of the less toxic, water-soluble iohexol and iopamidol [2]. Though the arachnoiditis is not evidenced, intrathecal metrizamide is yet linked with a large number of complications. Even notwithstanding the fact that such symptoms are more important in the case of higher levels of the spinal canal under investigation, even with the help of lumbar myelography alone, the development of

temporary side effects is quite remarkable. Weakness has been reported to occur in 21-60% of the patients [3], nausea in 3-33% [4], and vomiting in 7-24% patients [5]. Rarer and less persistent side effects of metrizamide lumbar myelography were dizziness [6,7], confusion or disorientation [9, 12, 24], aphasia [8,9], a worsening of back and leg pains [10,11], hallucinations [12], asterixis [13]

In the vast majority, these side effects are not very frequent, except the headaches, nausea and vomiting. It is interesting to highlight that we and other fellow students in various institutions have observed that such patients taking steroid therapies during myelography were observed to experience fewer gastrointestinal side effects. Report of such observations led us to carry out a two blinded clinical trial in order to establish the utility of oral dexamethasone in headache and gastrointestinal side effects of metrizamide lumbar myelography.

**Subjects and Methods**

This study was done on adult patients with chronic low back and/or leg pain whose lumbar metrizamide myelography. A total of 145 patients were informed to consent to taking part after reading an information sheet (Table 1). Each participant was placed in his/her treatment group randomly, using a random-numbers table, by pharmacist. All the subjects were instructed to take a capsule of dexamethasone (4 mg) or placebo at bedtime on the eve before the myelogram, at 7 Am on the day of the myelogram, at the time the subject is called to the radiology suite and 1 hour after the procedure is finished. Their pharmacy documented all the medications that the participants were taking and the information was stored without disclosing it to the subjects, researchers and the medical personnel. The patients had to starve 4 hours prior to the procedure despite the fact that clear fluids were not discouraged in the build-up to the procedure but after it as well to remain hydrated.

In the lumbar myelograms a few radiologists made use of the same methods. The needles were 22- or 20-gauge spine needles and the cumulative dose of metrizamide was 2000 or 3000 mg/dl. The protocol was also that the contrast substance should never go below the mid thoracic level. The distal thoracic spinal cord and conus were only investigated by the supine position. The CT was performed on most of the patients between 4-6 hours after myelography. The head of the subject was elevated on transportation and the chin in hyperflexed position on scanning. The patients were expected to rest in bed with their head elevated no less than 30 o over the bed during 8 hours after myelogram and then rest in a horizontal position during the next 16 hours.

**Measures**

The participants were requested to complete a 24-item symptom checklist at the start and 24 hours of the myelography. A Likert scale was used to measure the 24 symptoms in the presence and absence of the symptoms prior to and following the procedure: 0 = not at all; 1 = just a little; 2 = fairly much; 3 = very much; 4 = don’t know. These 24 did comprise the symptoms of the headache, back pains, and leg pains and gastrointestinal, genitourinary and central nervous system (CNS) symptoms (Table 2). To determine the size of the needle, volume and concentration of metrizamide to be used and conventional and CT myelographic results, the medical records of the subject were reviewed. Minnesota Multiphasic Personality Inventory (MMPI) is also filled by patients exhibiting low back pain and undergoing diagnostic evaluation in most instances. Each subject also had MMPI scores on hysteria, depression and hypochondriasis taken as and when the same was available. The number of those who did not respond to the inventory was twenty and they could not be present to give their scores.

**Methods of Analysis**

It is necessary to mention that most patients, who undergo a myelography, already have such symptoms of pre-procedure pain in the back, legs, and numbness of the legs or feet. As a result, the participants’ pre- and post-mylography symptom scores were computed as the difference between the two, which gave the side effects of the procedure. Higher scores represented worse symptoms, whereas lower scores represented better symptoms, and the scores of zero represented no changes. A lot of the symptoms were either infrequent or indistinct (no obvious majority of patients experienced worsening

or improvement). Further analysis included only the symptoms that had definite indicators of either improvement or worsening. Worsening symptoms were those where the proportion of patients with worsening symptoms was no less than 20 percent, and no less than three times the proportion of patients with improving symptoms. The criteria used to consider the symptoms improved were based on a minimum percentage of patients who improved of at least 20 percent and three times higher than the percentage of those who deteriorated. The symptoms that could not be referred to these categories were defined as low-frequency or uncertain. A low-frequency symptom was one which had a combined total of less than 35 percent of patients who reported an upward and an improvement, and an ambiguous symptom was one where the total percentage of patients reporting was above 35 percent. The list of symptoms and their severity is listed in Table 2.

**TABLE 1:** Descriptive Statistics of the Total sample and Treatment groups.

| **Demographic Variable** | **Total** | **Dexamethasone** | **Placebo** |
|---|---|---|---|
| **No. of subjects** | 145 | 65 | 80 |
| **Mean age (range)** | 45 (19-79) | 48 (24-79) | 42 (19-72) |
| **Gender (%)** | | | |
| - Male | 52.4% (76) | 44.7% (29) | 59.1% (47) |
| - Female | 47.6% (69) | 55.3% (36) | 40.9% (33) |
| **Positive myelogram (%)** | 52.4% (76) | 57.9% (38) | 47.7% (38) |
| **Positive CT scan (%)** | 52.4% (76) | 57.9% (38) | 47.7% (38) |
| **Previous back surgery (%)** | 51.3% (74) | 52.6% (34) | 50.0% (40) |
| **Needle size:** | | | |
| - No. of subjects | 120 | 55 | 65 |
| - % 20 gauge | 45% (54) | 35.7% (20) | 53.1% (34) |
| - % 22 gauge | 55% (66) | 64.3% (35) | 46.9% (31) |
| **Contrast material:** | | | |
| - No. of subjects | 110 | 55 | 55 |
| - Mean volume (range) in ml | 13 (8-18) | 13 (8-18) | 13 (11-17) |
| - Mean concentration (range) in mg/ml | 214 (180-270) | 214 (180-270) | 215 (190-250) |
| - Mean dosage (range) in g | 2.8 (1.7-3.2) | 2.7 (1.7-3.2) | 2.8 (2.3-3.2) |
| **MMPI personality scores:** | | | |
| - No. of subjects | 97 | 40 | 57 |
| - Mean (range) for depression (D) | 63 (46-94) | 64 (47-94) | 62 (46-80) |
| - Mean (range) for hysteria (Hs) | 65 (36-95) | 67 (36-95) | 63 (41-90) |
| - Mean (range) for hypochondriasis (Hy) | 66 (45-96) | 67 (45-96) | 65 (49-84) |

**TABLE 2:** Summative results of Patient Reports of Symptom after Myelography.

| Symptom | No. of Reports | % Worsened | % Improved |
|---|---|---|---|
| 01(w) Loss of appetite | 145 | 26.8% (39) | 8.5% (12) |
| 02(w) Increased thirst | 145 | 40.2% (58) | 4.9% (7) |
| 03(i) Backache | 145 | 14.5% (21) | 44.3% (64) |
| 04(w) Nausea | 145 | 44.4% (64) | 6.2% (9) |
| 05(i) Increased urination at night | 145 | 16.2% (23) | 15.0% (22) |
| 06(i) Leg pain | 145 | 6.2% (9) | 54.3% (79) |
| 07(I) Itchy or scratchy skin | 145 | 4.9% (7) | 12.2% (18) |
| 08(w) Headache | 145 | 62.2% (90) | 11.0% (16) |
| 09(i) Leg or foot numbness | 145 | 3.7% (5) | 45.0% (65) |
| 10(w) Vomiting | 145 | 20.7% (30) | 0% (0) |
| 11(I) Increased appetite | 145 | 9.8% (14) | 3.7% (5) |
| 12(I) Rashes | 145 | 0% (0) | 6.1% (9) |
| 13(i) Leg or foot weakness | 145 | 3.7% (5) | 48.7% (71) |
| 14(I) Blurred vision/flashing lights | 145 | 18.5% (27) | 3.7% (5) |
| 15(I) Difficulty urinating | 145 | 17.5% (25) | 2.5% (4) |
| 16(w) Dizziness | 145 | 33.7% (49) | 5.0% (7) |
| 17(I) Difficulty using hands | 145 | 16.2% (23) | 6.3% (9) |
| 18(a) Hyperactivity | 145 | 13.9% (20) | 25.3% (37) |
| 19(a) Tired/fatigued | 145 | 22.5% (33) | 25.0% (36) |
| 20(a) Difficulty sleeping | 145 | 30.9% (45) | 24.7% (36) |
| 21(I) Hallucinations | 145 | 11.0% (16) | 4.9% (7) |
| 22(I) Confusion | 145 | 12.3% (18) | 11.1% (16) |
| 23(I) Forgetfulness | 145 | 13.7% (20) | 12.5% (18) |
| 24(I) Difficulty paying attention | 145 | 16.0% (23) | 7.4% (11) |

In order to evaluate treatment effects, comparisons were done in terms of the percentage of subjects who had improved or worsened symptoms depending on the treatment groups. The chi-square test of independence was applied to test the correlation between the treatment and the kind of symptom reaction. In some instances, the general comparisons of the two treatments and symptoms could not be statistically significant, however, one symptom (e.g., worsening) compared the differences between the treatment groups significantly. In this, post hoc one-tailed test was carried out to assess the significance of difference in frequency of occurrence of symptoms (Table 3).

Since the main purpose of this research was to determine the efficacy of oral dexamethasone therapy in reducing headaches and gastrointestinal side effects of metrizamide lumbar myelography, the additional analysis was aimed at the investigation of the interaction of the treatment with patient peculiarities. The rho correlation coefficients were estimated concerning each of the treatment groups, with the relationship between the symptoms of interest (gastrointestinal problems and headache) and various factors (demographic factors, variables related to medical records (needle size, total metrizamide dose, conventional and CT myelographic results), and personality factors (MMPI scores

on hysteria, depression, and hypochondriasis). Table 4 represents the results of this analysis on the topic of nausea and vomiting.

**Results**

**Descriptive Statistics of the Aggregate Sample and Treatment Groups.**

The overall sample size was 145 patients who included 65 patients in dexamethasone group and 80 patients in placebo group. The average age of the overall sample was 45 years (maximum and minimum: 19-79). The mean age of the dexamethasone group was 48 years (range: 24-79) and the mean age of the placebo group was 42 years (range:19-72). With respect to gender, 52.4% of the total sample consisted of male (76/145) and 44.7% in the sample of both dexamethasone (29/65) and placebo (47/80). The proportion of female subjects was 47.6% (69/145) of the entire sample size, 55.3% (36/65) of the dexamethasone group, and 40.9% (33/80) of the placebo group (Table 1).

Both the total sample and both treatment groups had a percentage of positive myelograms and CT scans of 52.4 and 57.9 and 47.7 respectively. There was a history of previous back surgery in 51.3 (74/145) of the total sample, 52.6 (34/65) in the dexamethasone, and 50.0 (40/80) in the placebo group.

Concerning needle size, 120 of them were given 20-gauge or 22-gauge needle. The size of the needles was 20-gauge (54/120) and 22-gauge (66/120) with 45 and 55 percent respectively of the total sample. The percentage of patients that were given the 20-gauge needle (20/55) was 35.7; whereas the percentage of those that were given the 22-gauge needle (35/55) was 64.3 in the group under dexamethasone. The percentages of those who were given the 20-gauge needle in the placebo group were 53.1% (34/65) and those who were given 22-gauge needle were 46.9% (31/65).

As a control group, 110 patients were given the contrast agent. The mean contrast material volume was 13 ml (range: 8-18) and the dexamethasone and placebo groups did not differ. The overall sample mean was 214mg/ml (range: 180-270) with 214mg/ml (range: 180-270) in the dexamethasone group and the placebo group respectively. The average dosage was 2.8 grams (range: 1.7-3.2), and the difference between the groups is also minimal (2.7 g of dexamethasone and 2.8 g of placebo).

On the MMPI personality scores, 97 participants were given the test. The total sample mean of the depression score was 63 (range 46-94) and that of the dexamethasone group was 64 (range 47-94) and the placebo group was 62 (range 46-80). The overall sample hysteria score was 65 (range: 36-95) with dexamethasone being 67 (range: 36-95), and placebo is 63 (range: 41-90). The total sample had a mean hypochondriasis score of 66 (range= 45-96), and 67 with dexamethasone (range= 45-96) and 65 with placebo (range= 49-84).

**Symptom Reports by patients following myelography.**

A variety of symptoms were found to have different levels of decrease or increase in the patient report in symptom following myelography in the two treatment groups. In case of loss of appetite, 26.8% (39/145) of patients were worsening whereas 8.5% (12/145) patients were improving. Regarding increased thirst, 40.2% (58/145) of patients showed worsened symptoms and 4.9% (7/145) had an improvement. Backache was also reported to be aggravated by 14.5 percent (21/145) of the patients and was improved by 44.3 percent (64/145). In 44.4 per cent (64/145) of the patients, nausea was aggravated, and in 6.2 per cent (9/145) it was improved (Table 2).

On increased night urination, 16.2 (23/145) became worse, and 15.0 (22/145) improved. In leg pain, the rate of worsening was 6.2% (9/145) and 54.3% (79/145) of the patients improved significantly. Itchy or scratchy skin was made worse by 4.9% (7/145) and was made better by 12.2% (18/145). The most frequent symptom was headache where 62.2% (90/145) of patients reported that it worsened and 11.0% (16/145) reported improvement.

In case of leg or foot numbness, 3.7 (5/145) progressed and 45.0 (65/145) improved. There were 20.7% (30/145) patients who vomited aggravated, but not improved. Increased appetite deteriorated in 9.8% (14/145) of the patients and improved in 3.7 (5/145) patients. No worsening of the rashes, and 6.1

(9/145) improved. The weakness of the legs or feet was exacerbated in 3.7% (5/145) of the patients, and improved in 48.7% (71/145).

Improved (5/145) or worsened (27/145) in 18.5% and 3.7% respectively. Problems in urinating were aggravated in 17.5% (25/145) of the patients, and improved in 2.5 percent (4/145) of patients. The presence of dizziness was made worse in 33.7% (49/145) of the patients, and 5.0% (7/145) of the patients improved. The use of hands difficulty deteriorated in 16.2% (23/145) patients, and 6.3% (9/145) patients had improvement.

Twelve point nine percent (20/145) of patients aggravated hyperactivity, and 25.3 (37/145) patients were improved. There were 33/145 patients who had worsening of tiredness or fatigue and 36/145 had improvements. The sleeping problem was exacerbated in 30.9 (45/145) of the patients and it was improved in 24.7 (36/145). In 11.0% (16/145) of the patients, and 4.9% (7/145) the hallucinations were made worse and better, respectively. In 12.3 (18/145) of patients, confusion was aggravated, and 11.1 (16/145) patients improved.

The worsening (13.7% 20/145) and improving (12.5% 18/145) were experienced by the percentage of forgetfulness. Lastly, the inability to pay attention was aggravated in 16.0% (23/145) of patients, and improved in 7.4% (11/145).

These findings depict the spectrum of symptom changes that follow lumbar myelography with different degrees of gastrointestinal and neurological symptom changes in dexamethasone treatment group and placebo treatment group.

**TABLE 3:** Evaluation of Treatment Effects on Frequency of Worsening and Improving Symptoms After Myelography.

| Type: Reaction | Treatment | Test 1° | Test 2° | df | $\chi^2$ | p | Z | p |
|---|---|---|---|---|---|---|---|---|
| **Worsened:** | | | | | | | | |
| Loss of appetite | n=39 | 10.5 | 15.8 | 2 | 4.44 | .108 | 2.07 | |
| Increased thirst | n=58 | 2.6 | 44.7 | 2 | 1.15 | .562 | | |
| Nausea | n=56 | 8.1 | 37.8 | 2 | 1.38 | .501 | | |
| Vomiting | n=39 | 0 | 10.5 | 1 | 4.48 | .034 | 2.09 | |
| Headache | n=39 | 7.9 | 63.1 | 2 | 0.74 | .690 | | |
| Dizziness | n=56 | 5.4 | 40.5 | 2 | 1.54 | .462 | | |
| **Improved:** | | | | | | | | |
| Backache | n=39 | 55.3 | 15.8 | 2 | 3.98 | .137 | 1.86 | |
| Leg pain | n=39 | 57.9 | 0 | 2 | 4.71 | .095 | 2.17 | |
| Leg or foot numbness | n=56 | 51.4 | 8.1 | 2 | 5.64 | .059 | 1.88 | |
| Leg or foot weakness | n=56 | 51.4 | 0 | 2 | 2.70 | .260 | 1.88 | |

**TABLE 4:** Correlations of Gastrointestinal Symptom Deterioration by Patient Characteristics depending on Type of treatment.

| Statistic | Dexamethasone | Placebo | p |
|---|---|---|---|
| **Nausea, MMPI hysteria** | | | |
| r | 0.29 | -0.26 | 0.03 |
| p | <0.16 | <0.12 | |
| n | 39 | 56 | |
| **Vomiting, age** | | | |
| r | 0.05 | 0.44 | 0.02 |

| | | | |
|---|---|---|---|
| p | <0.77 | <0.01 | |
| n | 39 | 56 | |

The comparison of treatment on the changes in the symptoms after the myelography revealed that there was a great variation in the dexamethasone and placebo groups regarding some of the symptoms. Under the worsening symptoms category, there was a great difference in the vomiting symptoms with 10.5% of placebo patients developing worsening vomiting symptoms and none in the dexamethasone group. This has been determined to be statistically significant (2 = 4.48, p = 0.034, Z = 2.09). There was also a further deterioration in the placebo group compared to the dexamethasone group (15.8% versus 10.5) that was not statistically significant (2 = 4.44, p =.108). Increased thirst showed no significant differences (2 = 1.15, p = 0.562) and neither did increased nausea (2 = 1.38, p = 0.501).

In order to improve the symptoms, there was a significant difference between dexamethasone group (57.9) and placebo group (0%) in terms of the improvement of leg pain. This difference was no longer statistically significant (2 = 4.71, p = 0.095). It also improved the backache more in the placebo group (55.3) compared to the dexamethasone group (15.8) although the difference was not statistically significant (2 = 3.98, p = 0.137). The weakness in legs or feet and weakness in legs or feet numbness significantly improved in dexamethasone versus control group (48.7% versus 45.0%, respectively), but the difference between leg or foot weakness (2.70, p = 0.260) and leg or foot numbness (5.64, p = 0.059) was not statistically significant Table 3.

Table 4 In the nausea group, it was found that there was a positive relationship with MMPI hysteria scores with the dexamethasone group (r = 0.29, p < 0.16) but the relationship was not statistically significant. The negative correlation between the placebo group and other groups (r = -0.26, p < 0.12) was not significant either.

With regard to vomiting, there was also a positive relation to age in placebo group (r = 0.44, p < 0.01) whereby old patients were more prone to vomiting after the intervention. However, vomiting and age did not have any meaningful correlation in the dexamethasone group (r= 0.05, p= 0.77). These findings demonstrate that the patient variables particularly the age had an influence on incidences of vomiting in the placebo group but not the dexamethasone group.

**Discussion**

The existing research was caused by the empirical finding that patients in receiving steroid preparations during metrizamide myelography had less gastrointestinal side effects. It is based on this observation that we had preconceived and statistically found reduction of these symptoms in our controlled double-blind study. Though, the administration of dexamethasone did not completely decrease gastrointestinal side effects among all patients groups, the greatest protective effect was found in the group of decreasing the degree of vomiting, especially, in older patients.

Since that time, both iopamidol and ioxetol are approved of by the U.S. Food and Drug Administration in intrathecal use since our study has been completed. Several comparative studies have been done with these contrast agent. Although the incidence of such adverse effects as headache, nausea, and vomiting is less frequent in iopamidol and iohexol than in metrizamide, some percentage of patients have those side effects. Headache 17-58% of patients have complained of headache in lumbar myelography with iopamidol [14], 0-23% nausea and 0-23% vomiting. The myelography with the use of the Iohexol is better tolerated, and the headache rates, nausea rate, and vomiting rate are 1-24% [15], 1-10% [16], and 0-4% [17,18], respectively. However, during the past 5 months since switching to such newer contrast agents, three of the patients experienced severe and protracted vomiting.

Even though we cannot directly apply our findings on metrizamide to iopamidol and ionhexol, we do assume that with the general incidence rates of gastrointestinal side effects, even greater decreases in incidence may be achieved with oral dexamethasone due to the chemical parallels between these two agents. Dexamethasone premedication would be particularly helpful in patients who are having

metrizamide myelography, elderly and patients who have a history of severe and long lasting vomiting response when having myelography with any contrast agent.

The mechanism through which dexamethasone has antiemetic action has not been clearly identified, but it has been proposed that corticosteroids might suppress the production of the prostaglandins, which might be significant [19]. This has however not been experimentally proved. The hypothetical pathways of metrizamide toxicity are its difference with the osmolality of cerebrospinal fluid (CSF), and its poor solubility in water [20]. The glucose metabolism in the brain is the most universally thought of hypothesis.

D-glucose is the predominant energy source in the CNS [21] and the glucose in CNS cells is transported across the membranes via a facilitated membrane carrier. This carrier can be competitively inhibited by structural analogs to this carrier, such as D-glucosamine or 2-deoxy-D-glucose. Metrizamide is an amalgamate of 2-deoxy-D-glucose and metrizoate. The compound has been observed to suppress the metabolism of glucose in the neural tissues and D-glucose competing with the 2-deoxy-D-glucose on the particular carrier of the membrane [22]. It is known that metrizamide exerts a significant blockage of glucose metabolism in the white hippocamus of rat [23]. Bertoni et al. [24] have demonstrated the ability to inhibit glucose metabolism in vitro by use of metrizamide with a commercially available microbial hexokinase. The metrizamide inhibits the hexokinase and glucose metabolism depending on the levels of blood glucose level as the level of glucose in the blood affects the inhibitory effect of metrizamide. Therefore, such a competitive inhibition may be enhanced by factors that create big variations in the blood glucose such as fasting [25]. Dexamethasone is unlikely to act centrally in the thirst center of the brain or the emetic center of the brain. Another more reasonable explanation is that dexamethasone is a peripheral inhibitor of insulin release that provokes a hyperglycemic condition. The rise of the blood glucose would give the brain more glucose and hence limiting the effect of metrizamide on hexokinase. The hyperglycemia, which is another side effect of excess of glucocorticoids, may also explain the increased thirst of the subjects in the dexamethasone group. The fact that the metrizamide toxicity is less when an animal is at a systemic hyperglycemic condition also supports the hypothesis that the toxicity of metrizamide is associated with the drug disrupting the brain glucose metabolism.

## Conclusion

This trial showed that there was statistically significant reduction in gastrointestinal side effects especially vomiting in patients who were being administered dexamethasone in metrizamide lumbar myelography. Though the use of dexamethasone did not fully prevent all these side effects in every patient, the protective effect of the drug was especially clear in patients of older age. Although the improvements were witnessed, the study also pointed out that some of the symptoms like headache and nausea were still present after the procedure but reduced in severity in the dexamethasone group. To sum up, some of the gastrointestinal side effects linked to lumbar myelography were alleviated with the use of dexamethasone; however, additional research is still required to determine the full effects of this drug in the alleviation of other symptoms as well as to determine the ability to mitigate side effects with newer contrast agents such as iopamidol and iohexol. Also, taking into account the personal traits of patients, including age and personality can also contribute to the improved control of side effects after myelography.

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