

Evaluation of Entonox as an Analgesic for Relief of Pain in Patients with Acute Myocardial Infarction

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Abstract

Background- Since the relief of pain in patients with acute myocardial infarction (AMI) is very important; we sought to assess the effect of Entonox as an analgesic drug in our subjects. Our goal was to compare the analgesic effect of Entonox with opioid drugs such as morphine and meperidine.

Methods- This study was a randomized clinical trial, which included 120 patients with well-established AMI admitted to the CCU ward. Exclusion criteria consisted of hemodynamic abnormality, heart block, cardiac arrhythmia, opioid addiction and a lack of participation of certain patients. The patients were divided in a randomized manner into two equal groups of 60 individuals each. The first group inhaled Entonox, while the second group received opioid drugs intravenously. The severity of pain in the patients of both groups was measured before and after the aforesaid procedure by employing the established criteria of visual analogue scale (VAS). Visual analog scale is a standard quantitative method for pain measurement, which is suggested by the patient.

Results- Pain severity reduction according to VAS criteria in the Entonox group was 4.55 and 4.4 in the opioid group, which did not show any statistical difference according to t-test ($p=0.82$).

Conclusion- Entonox was as effective for pain relief as opioid drugs in patients with AMI. Given the known complications caused by opioid drugs, we should be able to substitute these drugs with Entonox (*Iranian Heart Journal* 2006; 7 (3):16-19).

Key words: acute myocardial infarction ■ analgesic ■ opioid ■ Entonox

Pain is an unpleasant sensation which accompanies tissue injury or destruction.^{1,2} As is well known, chest pain or chest discomfort is a cardinal manifestation of AMI, which can contribute to the heightened sympathetic activity that is particularly prominent during the early phase of AMI;³ therefore, pain sedation is very important in these patients.

Control of cardiac pain is typically accomplished with a combination of nitrates, analgesics, oxygen, and beta-adrenoceptor blockers.

Although a wide variety of analgesic agents have been used to treat the pain associated with AMI, including meperidine, pentazocine, and morphine, morphine remains the drug of choice, except in patients with well-documented morphine hypersensitivity⁴.

Because of the known complications caused by opioid drugs, such as hypotension, bradycardia, respiratory depression, nausea and vomiting, constipation, biliary colic, urinary retention, consciousness disturbances, itching, urticaria, angioneurotic edema, anaphylactic shock⁵, and drug addiction, we

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tried to use Entonox as an alternate analgesic agent.

Entonox is an equal admixture (half and half) of nitrous oxide (N₂O) and oxygen. N₂O is a colorless and odorless gas, which is neither flammable nor explosive⁶, and due to water insolubility it has a rapid onset of action (after 4-5 inspirations) and rapid elimination (from the lungs) without any metabolic changes in the body.^{7,8} N₂O at 30-50% concentration has an analgesic effect equivalent to 10mg intramuscular morphine⁹ and at 30-80% concentration, acts as a sedative.¹⁰ If N₂O is administered in combination with oxygen for short durations, there are no side effects, but pure N₂O administration for lengthy time periods can cause complications such as diffusive hypoxia, anemia, pneumothorax, pneumoperitoneum, leukopenia, paresthesia, numbness, and muscular weakness.¹¹

Methods

This study was a randomized controlled clinical trial, which included 120 patients with well-established AMI admitted to the CCU ward.

Exclusion criteria consisted of hemodynamic abnormality, hypotension, heart block, cardiac arrhythmia, opioid addiction, and a lack of participation of certain patients.

The patients were divided in a randomized manner into two equal groups of 60 individuals each. The first group inhaled Entonox with a special mask for 5 minutes, while the second group received 3mg morphine or 25mg meperidine intravenously. At all times of Entonox inhalation, we controlled heart rate, blood pressure and O₂ saturation of the patients.

The severity of pain in the patients of both groups was measured before and after the aforesaid procedure (in the Entonox group immediately after termination of Entonox inhalation, and in the opioid group 15 minutes

after morphine and 10 minutes after meperidine injection) by employing the established criteria of visual analogue scale.

Statistical analysis

All the analyses were performed with SPSS software, v10. Pearson and Chi-square tests were used to determine the difference of gender between the two groups.

Paired t-test for comparison of pain scale before and after inhalation of Entonox or injection of opioid drugs, and independent two sample t-test for comparison of pain scale difference before and after intervention in each group were also used.

Results

Patients of Entonox group were 66.7 percent male and 33.3 percent female. In the opioid group, 65 percent were men and 35 percent women (Table I, no statistical difference in sexual distribution between the two groups, p=0.8).

The mean of pain severity reduction according to VAS criterion in the Entonox group was 4.55 and 4.4 in the opioid group, (Table II), a which showed no statistical difference according to t-test (p=0.82).

Table I. Sex distribution in two groups as regard to type of analgesic drug.

Drug group	Men		Women		Total		P-value
	No.	%	No.	%	No.	%	
Entonox	40	66.7	20	33.3	60	100	Non-significant P = 0.8
Opioid Drugs	39	65	21	35	60	100	
Total	79	65.8	41	34.2	120	100	

Table II. Pain reduction as base of Visual Analog Scale (VAS) in two groups.

Drug group	Number	VAS	S.D	t *	p
Entonox	60	4.55	2.09	0.222	0.82
Opioid Drugs	60	4,4	2.01		

*Independent two samples t-test.

Discussion

O'Leary and coworkers¹² in a randomized double blinded cross-over study which included 12 patients with established AMI, first prescribed an admixture of 30% N₂O and 70% O₂ for 30 minutes, then an admixture of 30% air room and 70% O₂ for 30 minutes. The chest pain of 11 patients was reduced by N₂O and O₂, but none of them had pain reduction with air room and O₂. In another study by Thompson and coworkers¹³ which included 69 patients with established AMI, the patients received in a randomized manner pure O₂ or an admixture of 35% N₂O for 5 minutes. Chest discomfort declined in 90% of patients who received N₂O without any complication. Kerr and coworkers¹⁴ in a double blind trial, compared the analgesic effect of Entonox with O₂ in 81 patients with AMI. They reported the effectiveness of Entonox in chest pain reduction in 95% of the patients.

Also in our study in the patients with well-established AMI, pain severity reduction according to VAS criterion in the Entonox group was similar to that in the opioid group.

Conclusion

Entonox was as effective for pain relief as opioids in patients with AMI. Given the

known complications caused by opioid drugs, we should be able to substitute these drugs with Entonox.

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