

# Evaluating the effect of Valsalva maneuver on pain occurring during knee injection

## Abstract

**Background:** Intra-articular injection of steroid is a common treatment for osteoarthritis of the knee and injection is a simple and reliable method. However, many people refuse it because of fear of needle and injection pain. Baroreceptor activation induces antinociception and the use of Valsalva maneuver for its activation may help to decrease local injection pain.

**Aim:** This study was the first to evaluate the efficacy of Valsalva maneuver on needle insertion pain during local knee injection.

**Design:** prospective randomized trial.

**Setting:** study carried out on patients attending the outpatient clinic of rheumatology and rehabilitation department of Al-Azhar university hospital.

**Population:** patients with osteoarthritis and indicated for local knee injection.

**Methods:** Patients were randomized into 2 groups of 50 each.

- i. Group I: 50 patients with Knee Osteoarthritis were asked to do Valsalva maneuver during injection. The Valsalva maneuver is performed by having the subject conduct a maximal, forced expiration against a closed glottis and holding this for at least 16 seconds.
- ii. Group II: 50 patients with Knee Osteoarthritis were given a rubber ball in the palm of the hand and were asked to press it as hard as they could before local injection. All patients were subjected to: Complete history and clinical examination. Patient Pain scoring: pain during injection was evaluated using visual analogue scale (VAS) Physician pain scoring: Pain was graded using a 4-point scale: 0 \_ no pain, 1 \_ mild pain 2 \_ moderate pain 3 \_ severe pain. Local corticosteroid injection: of 40 mg of triamcinolone acetonide.

**Results:** The results of Pain score in group I was : 33 (66%) patients shows mild pain, 15 (30%) patients shows moderate pain and only 2 (4%) patients shows severe pain. In group II: 0% patient's shows mild pain, 23 (46%) patient's shows moderate pain and 27 (54%) patients' shows severe pain. Figure (1) VAS for pain was 3.7±2.1 in group I and 6.5±1.8 in group II. VAS for pain was significantly lower in group I than group II as p was >0.001.

**Conclusion:** In conclusion we suggest that Valsalva maneuver can decrease the skin puncture pain associated with local knee injection.

**Clinical rehabilitation impact:** reduction of injection pain may help the patients to decrease their pain and increase their acceptance to local injection procedures, and enhances the outcome of rehabilitation program.

**Keywords:** Valsalva maneuver; Knee injection; Pain; Osteoarthritis; Clinical rehabilitation; visual analogue scale; Skin puncture; Inflammation; Rheumatology radiologic; Clinical criteria

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**Ahmed F Abogamal**

Department of Physical medicine, Rheumatology and rehabilitation, Al-Azhar University, Egypt

**Correspondence:** Ahmed F Abogamal, Associate professor, Department of Physical medicine, Rheumatology and rehabilitation, Al-Azhar University, 94 Aiad Wasef St, Ain Shams, 11311, Cairo-Egypt, Email [ahmedfathy15@yahoo.com](mailto:ahmedfathy15@yahoo.com)

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## Introduction

Knee pain is relatively common and Osteoarthritis is the single most common cause of disability in older adults, with 10% of patients aged 55 or more having painful disabling osteoarthritis of the knee, and a quarter of them are severely disabled.<sup>1,2</sup> Treatment objective is directed to pain relief and improvement or maintenance of function as there is no cure.<sup>3,4</sup>

Intra-articular injection of steroid is a common treatment for osteoarthritis of the knee and injection is a simple and reliable method of for relieving pain and inflammation in patients with knee osteoarthritis. However many people refuse it because of fear of needle and injection pain.<sup>2,5-7</sup>

Many techniques have been used to decrease the pain of needle insertion such as Local anesthetics, attention-diverting measures (pressing ball) and EMLA patch. Local anesthetics may produce pain on injection site and the added value of local anesthetics over a straightforward needle puncture without analgesia is unsure by many physicians.<sup>8-10</sup>

The pain occurs during needle puncture has two components somatic and psychological. Pharmacological measures, such as the application of local anesthetics, deals with the somatic component of pain, whereas attention-diverting measures (pressing ball) targets the psychological component.<sup>8-10</sup>

A literature search revealed laboratory studies showing that baroreceptor activation induces nociception but there were few

clinical studies exploring the effect of the Valsalva maneuver on pain.<sup>11-14</sup> Agrawal and his colleagues reported that Valsalva maneuver performed before venous cannulation could decrease the incidence and severity of pain associated with venipuncture in adult patients.<sup>13</sup>

This study evaluated the efficacy of Valsalva maneuver on needle insertion pain during local knee injection.

## Patients and methods

The study was carried out on 100 patients attending the rheumatology outpatient clinic of ALAZHAR university hospitals with the following inclusion criteria:

Knee OA diagnosed according to: American College of Rheumatology Radiologic and Clinical Criteria for Knee Osteoarthritis.<sup>15</sup> Knee OA, grade II-III based on the Kellgren-Lawrence scale.<sup>16</sup>

Patients had moderate to severe pain not responding satisfactorily to oral analgesic/anti-inflammatory agents and patients with symptomatic knee OA with effusions or other physical signs of local inflammation.<sup>17</sup>

## Exclusion criteria

- Trauma to the affected knee in the preceding 6weeks.
- Patients with a past history of knee instability.
- Previous knee surgery.
- Patients with contraindications to injection therapy: Patients with bleeding diatheses, anticoagulant therapy, or Local infection.
- Patients with parenthesis.
- Cardiac patients and patients with hypotension.

## Grouping

Patients were randomized with the help of a computer-generated table of random numbers into 2 groups of 50 each.

**Group I:** 50 patients with Knee Osteoarthritis were asked to do Valsalva maneuver during injection. The Valsalva maneuver is performed by having the subject conduct a maximal, forced expiration against a closed glottis and holding this for at least 16seconds.<sup>13</sup>

**Group II:** 50 patients with Knee Osteoarthritis were given a rubber ball in the palm of the hand and were asked to press it as hard as they could before local injection.

## Methods

All patients were subjected to complete history and clinical examination.

## Patient pain scoring

Pain during injection was evaluated using visual analogue scale (VAS) VAS was assessed on a continuous scale of 0-10 where 0 stands for “no pain” and 10 stand for “worst imaginable pain.”

## Physician pain scoring

During the process of local injection, patients were observed and questioned by a rheumatologist. Pain was graded using a 4-point scale: 0 \_ no pain, 1 \_ mild pain (pain reported only in response to questioning without any behavioral signs such as facial grimacing, arm withdrawal, or tears), 2 \_ moderate pain (pain reported in response

to questioning and accompanied by a behavioral sign or pain reported spontaneously without questioning), and 3 \_ severe pain, i.e., strong vocal response or response accompanied with behavioral signs.<sup>18</sup>

## Local corticosteroid injection

Patients were given a local corticosteroid injection of 40mg of triamcinolone acetonide and of 2% lignocaine hydrochloride made up to a volume of 2ml injected.<sup>19</sup>

## Ethics statement

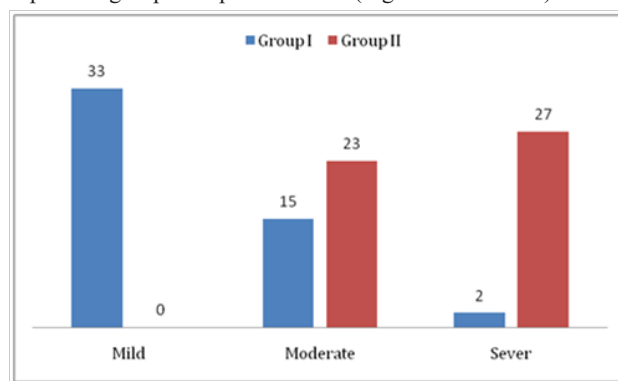
This intervention was noninvasive and previous studies reported that baroreceptor activation induces nociception. This trial was then registered with and approved by the Research Ethics Committee of ALAZHAR University. Patients were instructed about the procedure and informed consent was obtained separately before the study.

## Results

Statistical analysis of the demographic data in group I show that age was 44.6+8.9, Weight 81.9+10.5 and sex 29 (58%) female, 21 (42%) male. In group II age was 41.7+9.4, Wight 78.3+11.3 and sex 30 (60%) female, 20 (40%) male.

The results of Pain score in group I was: 33 (66%) patients shows mild pain, 15 (30%) patients shows moderate pain and only 2 (4%) patients shows sever pain. In group II: 0% patient's shows mild pain, 23 (46%) patients' shows moderate pain and 27 (54%) patients shows sever pain. Table (1), Figure (1) VAS for pain was 3.7+2.1 in group I and 6.5+1.8 in group II.

Comparison of both groups shows no significant difference as regard the age, weight and sex distribution as P was < 0.05. on the other hand the pain score and VAS for pain was significantly lower in group I than group II as p was >0.001 (Figure 1 & Table 1).



**Figure 1** Shows results of pain score in both groups.

**Table 1** Shows the results of pain score in both groups

	Group I		Group II	
	N	%	N	%
Mild	33	66	0	0
Moderate	15	30	23	46
Sever	2	4	27	54

## Discussion

This study suggests that performing Valsalva maneuver during local knee injection reduces the severity of local needle puncture pain.

During Valsalva maneuver intrathoracic pressure increases. This increase in turn results in compression of the vessels inside the chest which results in baroreceptor activation of either the cardiopulmonary

baroreceptor reflex arc or the sinoaortic baroreceptor reflex arc known to induce antinociception and in turn decrease the severity of pain.<sup>14,20</sup>

This mechanism could explain the results of this study as we report a significant difference between both groups at the level of VAS for pain as it was 3.7 in group I and 6.5 in group II. The percent of pain severity also differs significantly between both groups group I was: 33 (66%) patients had mild pain, 15 (30%) moderate pain and only 2 (4%) patients had severe pain while in group II: 0% had mild pain, 23 (46%) patients had moderate pain and 27 (54%) had severe pain.

These results express the added value of Valsalva maneuver (performed in group I) in antinociception over the attention diverting method pressing a rubber ball, (performed in group II). So the antinociception induced by baroreceptor reflex arc activation through Valsalva maneuver found to have a significant clinical application as it is effective, simple, easy, safe, and totally inexpensive method for antinociception.

This valuable clinical application of Valsalva may help the patients indicated for local injection by decreasing needle insertion pain and increase their acceptance to such local intervention. Increasing the acceptance of local injection in such common and chronic disease as Knee osteoarthritis will finally help to improve the pain, inflammation and functional outcome of very large category patients.

There were few studies for evaluating the efficacy of Valsalva maneuver on pain and this was the first study to evaluate the efficacy of Valsalva maneuver on pain of local knee injection. In study by Agrawal et al, the efficacy of the Valsalva maneuver on pain associated with venous cannulation were evaluated on Seventy-five adults patients undergoing elective surgeries. They were randomized into three groups of 25 each. Group I (C): control; Group II (V): blew into sphygmomanometer tubing and raised the mercury column up to 30mmHg for 20 s; Group III (B): pressed a rubber ball. Twenty seconds later, peripheral venous cannulation was performed. Venous cannulation pain was graded using a 4-point scale: 0-3, where 0= no pain, 1= mild pain, 2= moderate pain and 3= severe pain, and visual analog scale of 0-10, where 0=no pain and 10= worst imaginable pain.<sup>13</sup>

Agrawal et al used both, 4-point scale and VAS, in which the first scaling was used during the cannulation and VAS, was used after the cannulation. They found a significant reduction in the incidence of pain in the Valsalva group: 18 of 25 (72%) patients, whereas 25 of 25 (100%) experienced pain in the other two groups (p<0.001). These findings were also correlated with our study.<sup>13</sup>

## Conclusion

Conclusion we suggest that Valsalva maneuver can decrease the skin puncture pain associated with local knee injection which may help the patients to decrease their pain and increase their acceptance to local injection.

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## Conflicts of interest

Author declares there are no conflicts of interest.

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