Efficacy of "cough-trick" in reducing pain during spinal anesthesia: a prospective, randomized clinical study

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Abstract

Many pharmacological and non-pharmacological approaches have been described to reduce spinal puncture pain. Non-pharmacological approaches such as attention-diverting strategies and audio-visual distraction are used alongside pharmacological methods such as local anesthetic injection with lidocaine. The repeated-cough "cough-trick" is one of the simplest non-pharmacological methods used to reduce spinal puncture pain, although the underlying mechanism remains unclear. This study aimed to evaluate the efficacy of the cough-trick compared to local anesthesia infiltration with lidocaine to reduce puncture pain during spinal anesthesia. In a prospective, randomized clinical study; two hundred patients (98 male and 102 female) were included in our study. Participants were randomly allocated into two groups. For group A, the skin and subcutaneous tissue were infiltrated with 3 mL of 1% lidocaine without vasoconstrictor, whereas in group B, we asked the patient to repeatedly cough during the insertion of the spinal needle. The pain intensity during spinal anesthesia induction was evaluated using a visual analog scale (VAS).

Two hundred patients were included in the study for their first surgery with spinal anesthesia. We found no significant difference between groups A and B regarding sex, age, and BMI. No significant differences existed (P=0.607) between the two groups in the Hamilton Anxiety Rating Scale before the implication of subcutaneous lidocaine infiltration in group A or using the cough-trick intervention in group B. No significant differences (P=0.772) were found between the groups in VAS scores for evaluating the severity of pain during insertion of the spinal needle. The pain-reduction effect of the cough-trick was equivalent to local anesthesia

infiltration with lidocaine. The cough-trick is a simple, inexpensive, and effective non-pharmacological method for pain relief that can be used to reduce spinal puncture pain.

Keywords: Cough-trick; Distraction; Spinal anesthesia; Lidocaine; Visual analog scale.
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INTRODUCTION

Skin puncture is a painful and upsetting experience for almost every patient having spinal anesthesia. The patient suffers both physical and psychological trauma as a result of the skin puncture. Physiological and psychological factors influence the perception of skin puncture pain during any invasive technique.[1-3] Fear of needles, unanticipated events, and pain anticipation are all psychological factors that might influence pain perception. Anxiety and physiological reactions to subsequent procedures can be exacerbated by pain experienced during skin puncture.[2,4]

The pain of spinal needle puncture can be stressful for patients having spinal anesthesia, leading to refusal due to the anxiety of puncture pain and postoperative backache. Pain from spinal needle puncture has physical and psychological elements.[2,4] In most patients, these insertions cause pain, which leads to discomfort, stress, unintended moving, and failure of the insertion or spinal block. Different methods have been evaluated to decrease pain during spinal anesthesia.[3] In the literature, various ways of reducing spinal puncture pain have been published.[4] Only the somatic component of pain is reduced by pharmacological techniques such as local anesthetic infiltration. Infiltration of local anesthesia is a painful technique itself.[3,5] On the other hand, infiltration before puncture is a popular and successful method of reducing puncture pain.[3,5] Attention-diverting measures (e.g., rubber ball squeezing and audio-visual distraction) are non-pharmacological ways for reducing pain's psychological component. When attention is diverted away from a painful task, neurocognitive processes directing pain perception might be disturbed.[1,6]

The "cough-trick" technique, involving repeated coughing on command during skin puncture, is a simple method of pain alleviation during peripheral venipuncture and other injections.[1,7] Previous studies have demonstrated the usefulness of the cough-trick in pain reduction during peripheral venipuncture, vaccine injections, and biopsy. The cough-trick may be used alone or with other breathing techniques (e.g., balloon inflation or Valsalva maneuver).[1,4,7] It can be performed by all age groups without any additional equipment, costs, or efforts by medical staff, unlike other traditional methods of pain relief, such as applying or injecting local anesthetics.[1] Although the fundamental processes of the cough-trick's pain-relieving actions remain unknown, various theories have been presented to explain this phenomenon.[4] It could be a distraction, which is a well-known method of pain relief that involves shifting attention

to non-painful stimuli in the surrounding environment.[4] However, the findings of previous clinical trials on pain treatment by distraction are controversial.[7,8] This study aimed to verify the effectiveness of the cough-trick in comparison to local anesthesia infiltration with 1% lidocaine in reducing skin puncture pain during spinal anesthesia.

PATIENTS AND METHODS

Ethics approval and consent to participate:

All protocols and investigations of our study followed the regulations of the research ethics committee of Al-Azhar University and Aljadaani Hospital. All patients included in the study were aware of the techniques and aim of the study. All participants have given their informed written consent.

UMIN trial registration number: (UMIN000047143)

Study design and participants:

This study was a prospective, randomized trial carried out on 200 patients of different ages and both sexes who attended Aljadaani Hospital scheduled for elective surgery under spinal anesthesia from February 2019 to May 2021.

Sample size estimation:

Using the two-tailed Z test for proportions, the minimum sample size for each group was estimated at 89 patients, assuming a type I error of 0.05 and a target power value of 95%. A total of 100 patients were included in each group to account for probable dropouts.

The exclusion criteria were a history of peripheral neuropathy, inability to understand or communicate, anxiety disorders (defined by the Hamilton Anxiety Rating Scale[9]), failure of the first insertion of the needle, allergy to lidocaine, or patient refusal to participate in the study. Any patients using antidepressants, analgesics, anticonvulsant sedatives, or alcohol were also excluded.

Methods

A complete medical history was taken from all participants, concentrating on mental state examination to exclude any psychiatric disorders; the Hamilton Anxiety Rating Scale was applied for all patients to exclude anxiety disorders. All participants' ear lobules were punctured to familiarize them with pain scoring on a 100-mm visual analog scale (VAS-100). On this scale, 0 mm equals "no pain," and 100 mm equals "worst pain imaginable." No patient received pre-anesthetic medication. Patients were randomly divided into two groups corresponding to age, sex, and body mass index (BMI). After monitoring with non-invasive blood pressure and pulse oximetry, the patients were positioned in lateral decubitus for the punctures. Lumbar puncture was performed by the same anesthetist (RE) for all patients.

For group A (lidocaine group), the skin and subcutaneous tissue of a lumbar interspinous space (L3–L4 or L4–L5) were infiltrated with 3 mL of 1% lidocaine without vasoconstrictor using a 25G needle of 10 mm, before subarachnoid puncture with a 25G Quincke needle. The interval between infiltration and puncture with 25G Quincke needle was within 30 seconds.

For group B (cough-trick group), the cough technique was carried out as previously described.[1] After positioning the patient in lateral decubitus, the patient was asked to cough repeatedly, and the spinal needle was inserted during coughing. The cough-trick needs to coincide with the lumbar puncture for the most significant influence. The trial was conducted in the same room every day from 7:00 AM to 12:00 PM to reduce the impact of circadian changes on pain sensitivity.

Outcome measures:

The pain intensity during spinal anesthesia induction was evaluated using the VAS-100[7], ranging from 0 (no pain) to 100 (extreme pain). Patients were told to mark a point on the VAS ruler that represented the level of pain they were experiencing. The VAS-100 scale was shown to the participant immediately after spinal anesthesia induction by the second researcher (YH) ("assessor"), who was requested to leave the room during induction to be blinded to the interventional technique.

Statistical analysis

The sample size was calculated with a power of 95% and a significance level of 0.05. We used SPSS version 9.01 (SPSS Inc., Illinois, USA) for data analysis. The Mann–Whitney test used correlation and paired-sample statistics to evaluate statistical differences.

RESULTS

Two hundred patients were included in the study for their first surgery with spinal anesthesia. We found no significant difference between groups A and B regarding sex, age, and BMI. No significant differences existed (P=0.607) between the two groups in the Hamilton Anxiety Rating Scale before the implication of subcutaneous lidocaine infiltration in group A or using the cough-trick intervention in group B. No significant differences (P=0.772) were found between the groups in VAS scores for evaluating the severity of pain during insertion of the spinal needle (Table 1).

DISCUSSION

Non-pharmacological therapies such as counter-stimulation, music, and physical and psychotherapies can effectively relieve dysphoria and pain. Several non-pharmacological therapies can help with anxiety and pain after surgery.[4,10] The psychological element of pain may cause the patient to focus on anything other than their environment. Distraction is a cognitive-behavioral method for diverting attention from a source of pain in the immediate environment by changing the attention framework.[9, 11] Distraction helps patients cope with procedure discomfort by reducing the severity of pain, fear, and anxiety. Distraction techniques such as balloon inflation, music therapy, coughing, and the Valsalva maneuver have been studied.[1,2,6]

Previous studies have compared non-pharmacological interventions to subcutaneous lidocaine infiltration in pain control during spinal anesthesia.[5,11,12] The trials have generally indicated moderate effects. Nonetheless, the most important

question for physicians is not whether one intervention is better than another but which intervention is the most successful. Subcutaneous lidocaine infiltration before puncture is a common and effective technique to decrease puncture pain scores.[5] However, the problems of this technique are that the injection is itself painful, and getting to the target site for analgesia can sometimes be difficult.[12]

Our prospective randomized study evaluated the effects of the cough-trick to reduce pain during spinal needle insertion by comparing this technique to subcutaneous lidocaine infiltration during spinal anesthesia. No significant difference (P=0.772) existed between the groups in VAS scores. The efficacy of the cough-trick was equivalent to subcutaneous lidocaine infiltration to decrease pain in spinal anesthesia. The effect of the cough-trick could be explained by attention distraction, a well-known method for pain alleviation. Other possible explanations for our findings are that increased pressure in the subarachnoid region during coughing, mediated by vagal afferents, activates segmental pain inhibitory pathways; or release of endogenous endorphin, which is implicated in decreasing pain.[7,8]

The current study agrees with previous clinical studies that have found the cough-trick decreased pain as much as the injection of local anesthetic during cervical[11] and colposcopy-guided biopsy[4].

In a recent study, Usichenko et al. [7] reported that pain intensity was lower in venipuncture with the cough-trick than with "weak" distraction with rubber ball squeezing (P=0.03). Pain levels were comparable between the cough-trick and "strong" distraction with 200-mmHg inflation of the tourniquet on the same arm where venipuncture was performed. Additionally, no difference was found between pain after naloxone infusion with and without the cough-trick. Usichenko et al. concluded that the efficacy of the cough-trick might be related to the activation of segmental pain inhibitory circuits during coughing, as shown by the absence of pain relief by the cough-trick in the presence of opioid antagonists. The non-pharmacological intervention's apparent reduction in skin puncture pain could be related to the distraction component and the antinociceptive mechanism mediated by the sinoaortic baroreceptor reflex arc. According to a previous study, antinociception is induced by stimulating the baroreceptor reflex arc.[13] The sinoaortic baroreceptor reflex arc maintains circulatory homeostasis by adjusting parasympathetic and sympathetic efferents to the cardiovascular system through peripheral receptors and the CNS. Cardiovascular stimuli's peripheral activation of the sinoaortic baroreceptor reflex arc involves CNS, which lowers pain. The antinociceptive activity of the sinoaortic baroreceptor reflex is mediated by three mechanisms: the release of opioid-like substance-P into circulation; the secretion of a vasoconstrictor such as noradrenaline, which raises blood pressure

and directs blood flow towards the heart; and an increase in central blood volume.[14]

In contrast to other non-pharmacological distraction methods, the cough-trick does not require any additional equipment or expertise. Even children and patients who cannot perform other distraction methods due to disabilities or impairments could likely efficiently perform the cough-trick.[7]

Limitation of the study

The limitation of our study was the non-availability of advanced facilities for observing the levels of stress hormones (noradrenaline, adrenaline, and cortisol).

Conclusion

The pain-reduction effect of the cough-trick was equivalent to local anesthesia infiltration with lidocaine. The cough-trick is a simple, inexpensive, and effective non-pharmacological method for pain relief that can be used to reduce spinal puncture pain.

Declarations

Ethics approval and consent to participate: All protocols and investigations of our study followed the regulations of the research ethics committee of Al-Azhar University and Aljadaani Hospital. All participants have given their informed written consent.

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Authors' contributions: RE, IS, and YH designed the study, followed the patients, analyzed the data, and drafted the manuscript. KS and IS drafted the manuscript. All authors were involved in the critical analysis of the final version of the manuscript. All authors approved the manuscript as submitted and agree to be accountable for all aspects of the work.

Data Availability Statement: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Variable	Group A	Group A	p-value
Sex (N; %)			
Male	47 (47%)	51(51%)	
Female	53 (53%)	49(49%)	0.560
Age (year)			
Mean ± SD	31.95 ± 4.33	30.95 ± 5.41	0.551
Range	19-55	22-57	
BMI (Mean ± SD)	35.39 ± 8.9	34.25 ± 9.06	0.371
Hamilton (Mean ± SD)	6.92 ± 1.62	6.17 ± 1.87	0.607
VA Scale (Mean ± SD)	40.2 ± 13.8	39.5 ± 14.4	0.772

Table 1: comparison of both studied groups