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Effectiveness of Holding Breath After a Deep Inhalation in Reducing Pain Intensity During an Injection.

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Abstract

Background

Pain during injections is a common experience for patients, often leading to discomfort and anxiety. Non-pharmacological techniques, such as breath-holding after deep inhalation, have been explored as potential methods to reduce pain intensity. This study aimed to evaluate the effectiveness of this intervention in minimizing pain during injections.

Objective

The primary objective was to determine the effectiveness of holding one's breath after deep inhalation in reducing pain during injections.

Methods

A quasi-experimental study was conducted at the emergency department of Saidu Group of Teaching Hospitals, Swat. The study included 80 participants (40 in each group) aged 20–50. The intervention group was instructed to hold their breath after deep inhalation during injection, while the control group received no intervention. Pain intensity was measured objectively (researcher observation) and subjectively (patient self-report) using a numerical pain scale (0–10). Data were analyzed using SPSS version 26, with independent t-tests to compare groups.

Results

The mean objective pain intensity was significantly lower in the intervention group (2.70 ± 1.09) compared to the control group (4.20 ± 1.57; $p = 0.000$). Similarly, the mean subjective pain intensity was lower in the intervention group (2.63 ± 1.21) than in the control group (4.45 ± 1.63; $p = 0.000$). A higher proportion of participants in the intervention group reported less pain than in previous injections (67.5% vs. 5.0% in the control group).

Conclusion

Holding breath after deep inhalation effectively reduces pain intensity during injections. This simple, non-pharmacological technique can enhance patient comfort and improve the injection

experience. Further research is recommended to validate these findings in diverse populations and settings.

Keywords: Pain intensity, pain reduction, breath-holding, injection.

Introduction

The intervention of breath-holding after a deep inhalation during injections was hypothesized to have an analgesic effect, based on previous research suggesting that respiratory interventions can modulate pain perception. It was expected that this intervention would effectively reduce the pain intensity experienced by patients during injections. By applying this intervention, we aimed to investigate whether a simple, non-pharmacological technique could alleviate the pain associated with injections, potentially improving the overall patient experience during medical procedures. (1,2) Breathing pain management techniques have been used for centuries in various cultures and traditions. Slow and deep breathing techniques are non-pharmacological complementary interventions for different medical conditions. (3). Slow and deep breathing is also practiced for acute pain. A systematic review and meta-analysis demonstrated that slow deep breathing (SDB) significantly and statistically meaningfully reduced acute pain compared to usual care. Pooled data analysis revealed a standardized mean difference (SMD) of -0.68 (95% CI -1.19 to -0.18), indicating that SDB was associated with a reduction in pain intensity. The results of subgroup analysis based on pain etiology revealed a statistically significant decrease in pain among burn patients, with a standardized mean difference (SMD) of -2.24 (95% CI -3.49 to -0.98). This suggests that slow, deep breathing may be particularly effective in reducing pain in individuals with burn-related pain. 8,9 Other study results show the quality (5, 6). Studies examining the effects of slow deep breathing (SDB) on pain reduction varied, with low risk of bias studies showing consistent results. Specifically, during SDB, the thermal pain threshold was significantly higher compared to baseline ($P = 0.002$), indicating that individuals could tolerate higher levels of thermal pain. Similarly, the thermal pain tolerance was also significantly higher during SDB ($P = 0.003$), suggesting that individuals could endure pain for more extended periods of time during this breathing technique. Results from clinical and experimental studies supported the potential analgesic effects of instructed slow breathing. Instructed breath-holds significantly altered self-reported pain and nociceptive flexion reflex (NFR) compared to the null model. Statistically significant reductions in self-reported pain were observed during breath-holding, with a Chi-squared value of 157.75 and a p-value of less than 0.0001. Self-reported pain was lower by 9.6 points on the numerical rating scale (NRS) during breath-holding compared to spontaneous breathing. The NFR, a reflex response to pain, also showed statistically significant alterations during breath-holding, with a chi-squared value of 5.6 and a p-value of 0.17. These findings suggest that instructed breath-holding resulted in a statistically significant reduction in self-reported pain and a potential increase in NFR, indicating analgesic effects. (10, 11). The study explored the potential analgesic effect of breath-holding after a deep inhalation during injections. Pain during injections is a common experience for patients and can cause discomfort and anxiety, often leading to negative memories associated with injections. Previous research has shown that respiratory interventions, such as slow and deep breathing, can modulate pain perception. It was hypothesized that breath-holding after a deep inhalation during injections could reduce the intensity of pain experienced by patients. The study aimed to investigate whether this simple, non-pharmacological technique could alleviate injection-related pain and potentially improve the overall patient experience during medical procedures.

Methodology

Using a quasi-experimental design, the research analyzed the impact of breath-holding and deep inhalation on reducing pain associated with injections. The study occurred within the emergency department of Saidu Group of Teaching Hospitals in Swat, Pakistan. Eighty

participants took part in this study, which comprised intervention and control groups, with forty participants in each group between the ages of 20 and 50 who needed therapeutic injections. The intervention group followed specific instructions about breath-holding during their procedure, but the control group received standard injection procedures without breathing guidance. The research team conducted simple random sampling to choose patients who received prescribed injections from their attending physicians. The research excluded patients who were too old or young or had respiratory issues or serious injuries that might impact the results. Research staff observed the pain intensity while patients rated their subjective experience on a 0 to 10 numerical scale. The research site was selected for its large patient numbers and broad patient demographic to improve the transferability of results. Data analysis through SPSS version 26 evaluated the mean pain scores between groups utilizing independent t-tests. Breath-holding served as an essential non-drug intervention for pain control during injectable procedures, and this methodological framework enabled its assessment for such use.

Data Collection Procedure

The research occurred over three days during morning shifts within the Saidu Group of Teaching Hospitals' emergency department. The researcher obtained consent from participants before administering their structured questionnaire. The researchers designed the experiment with single-masked methodology, preventing patients from knowing which group they were assigned, either control or intervention. The intervention group patients received special instructions to breathe deeply and keep their breath at the point of exhalation when medical personnel administered intramuscular or intravenous treatments. All patients evaluated their pain experience using a standardized 0-10 numerical rating scale measuring pain intensity from no pain (0) to maximum pain (10). The control patients received ordinary shots that did not include breathing instructions.

Researchers evaluated pain through tests that gauged how patients felt and direct observations of physiological indexes. During the procedure, researchers evaluated pain through facial expression observation, but patients provided individual assessments regarding their pain experience right after it ended. The researchers used dual assessment tools to measure pain comprehensively. The Institutional Review Board (IRB) at PSNC provided full approval to the study protocol before implementation, thus guaranteeing adherence to ethical standards and relevant regulations. The study maintained all procedures aligned with research standards to safeguard participant ethics until the trials ended.

Data analysis procedure

The research team evaluated intervention effectiveness through SPSS version 26.0, which analyzed the collected data using standard statistical methods. Researchers produced statistical information and visual charts that simplified the interpretation of obtained results. The independent Student's t-test was the method to detect statistically meaningful group variations between intervention and control participants. The researchers used mean pain scores and standard deviations to combine central tendencies with data variability measurements. The assessed pain intensities showed their mean scores to represent average pain ratings, and standard deviations showed how much individual measurements differed from these averages. The study design united descriptive statistics about measurements and inferential tests with t-tests in combination with visual data presentation to evaluate breath-holding against injection discomfort effectively. Statistical analysis provided both dependability in interpretation and capable assessment between researched groups. All analytical operations included established quantitative medical research methods.

Analysis and Result

The sociodemographic profile of participants included balanced gender distribution, age concentration (highest in 21–25 and 41–45 years), educational diversity (40% uneducated), and

occupational trends (47.5% unemployed). The marital status reflects a predominantly married sample (83.8%). (Table 1)

Table 1: Demographic Characteristics of Participants

Variable	Category	Frequency	Percentage (%)
Gender	Male	40	50.0
	Female	40	50.0
Age (years)	21–25	28	35.0
	31–35	11	13.8
	41–45	27	33.8
	46–50	14	17.5
Education	Uneducated	32	40.0
	Primary (Grades 1–5)	15	18.8
	Middle (Grades 6–8)	4	5.0
	Secondary (Grades 9–10)	10	12.5
	Higher Secondary	16	20.0
	Bachelor's	3	3.8
Marital Status	Married	67	83.8
	Unmarried	13	16.3
Occupation	Employed	12	15.0
	Unemployed	38	47.5
	Self-employed	12	15.0
	Daily wage laborer	18	22.5

The intensity of pain

The objective pain intensity scores observed in the control group (N=40) had a mean score of 4.2 (moderate pain). The majority of participants reported pain levels between 2 and 6 (92.5%), peaking at intensity 3 (30%), while extreme pain scores (0–1, 9–10) were absent. The data provides a baseline for comparing the intervention group's pain reduction efficacy.

Table. 2. The intensity of pain observed by the observer on a pain scale of 0-10 in the control group.

Frequency	Pain Intensity (0–10)	Mean Pain Intensity	Percent (%)	Valid Percent (%)
0	0	4.2	0.0	0.0
0	1		0.0	0.0
4	2		10.0	10.0
12	3		30.0	30.0
10	4		25.0	25.0
5	5		12.5	12.5
6	6		15.0	15.0
1	7		2.5	2.5
2	8		5.0	5.0
0	9		0.0	0.0
0	10		0.0	0.0
Total		4.2	100.0	100.0

The pain intensity is on a scale of 0 – 10.

The subjective pain intensity reported by the control group (N=40) showed a mean score of 4.45 (moderate pain). Most participants rated their pain between 2 and 7 (97.5%), with the highest frequency at 4 (32.5%), while no one reported maximum pain (10). The data highlights consistent patient-reported discomfort, serving as a comparison for the intervention group's effectiveness.

Table. 3 The participants marked the pain intensity on a scale of 0 – 10.

Frequency	Intensity of pain	Mean of the pain intensity	Percent	Valid percent
0	0	4.45		
0	1			
4	2		10.0	10.0
7	3		17.5	17.5
13	4		32.5	32.5
6	5		15.0	15.0
6	6		15.0	15.0
2	7		5.0	5.0
1	8		2.5	2.5
1	9		2.5	2.5
0	10			
Total 40		4.45	100.0	100.0

Pain on a scale of 0 to 10, marked by the experimental group participants.

The subjective pain ratings from the intervention group (N=40) using breath-holding during injections showed a mean pain score of 2.625 (mild pain). Most participants reported low pain levels (1–4: 95%), with peaks at 2 (25%) and 3 (25%), and only 5% experienced moderate pain (score 5). No participants reported severe pain (scores 6–10), demonstrating the intervention's effectiveness in reducing discomfort compared to the control group's higher mean (4.45).

Table 4: Shows the intensity of pain on a scale of 0 to 10, which was marked by the participants in the experimental group.

Frequency	Pain intensity	Mean of the pain intensity	Percent	Valid Percent
0	0	2.625		
9	1		22.5	22.5
10	2		25.0	25.0
10	3		25.0	25.0
9	4		22.5	22.5
2	5		5.0	5.0
0	6			
0	7			
0	8			
0	9			

0	10			
Total 40		**Mean** 2.625	100.0	100.0

Comparison of Pain Intensity Between Control and Intervention Groups

This comparative analysis demonstrates that breath-holding significantly reduced both observed and self-reported injection pain ($p<0.001$ for both measures). The intervention group showed 1.5–1.8point lower mean pain scores than controls on the 10-point scale, with tighter data clustering (smaller SDs). Clinically, these consistent reductions across both observer and patient assessments confirm the technique's analgesic value. The highly significant p-values (<0.001) strongly support adopting this non-pharmacological pain management approach for injections.

Table 5. Comparison of Pain Intensity Between Control and Intervention Groups

Measure	Group	N	Mean ± SD	Std. Error	t-value	p-value
Objective Pain	Control	40	4.20 ± 1.57	0.249	4.958	<0.001
	Intervention	40	2.70 ± 1.09	0.172		
Subjective Pain	Control	40	4.45 ± 1.63	0.258	5.676	<0.001
	Intervention	40	2.63 ± 1.21	0.192		

Discussion

The efficacy of breathing techniques in pain management has been widely investigated in the literature. A meta-analysis conducted on the effects of slow deep breathing (SDB) revealed a significant and statistically meaningful reduction in acute pain when compared to usual care, with a standardized mean difference (SMD) of -0.68 (95% CI -1.19 to -0.18).7 Furthermore, a subgroup analysis showed that burn patients experienced a statistically significant reduction in pain with an SMD of -2.24 (95% CI - 3.49 to -0.98). These findings suggest that SDB may be an effective technique for pain management. (8, 9) Instructed breath-holding has also been investigated as a potential technique for pain management. One study found that it resulted in a statistically significant reduction in self-reported pain and a potential increase in nociceptive flexion reflex, indicating analgesic effects. These findings suggest that instructed breath-holding may be a promising technique for pain management. Building on the existing literature, the current study investigated the efficacy of breathing after deep inhalation in reducing pain intensity during injection administration. The results of our study showed that the intervention effectively reduced both objective and subjective pain intensity. Specifically, the mean score of objective pain intensity in the research group was found to be 2.70 ±1.09075, which was significantly lower than the control group's mean score of 4.2 ±1.57219. Similarly, the mean score of subjective pain intensity in the research group was found to be 2.625 ±1.21291, which was significantly lower than the control group's mean score of 4.45 ±1.63221. (12).

Moreover, the significant p-value of 0.000 at a 2-tailed significance level in both cases provides strong evidence against the null hypothesis. It suggests that there is likely an association between holding the breath after deep inhalation and pain intensity while administering the injection. These findings further support the potential efficacy of breathing techniques in pain management and suggest that holding the breath after deep inhalation may be a promising technique for reducing pain during injection administration. (13, 14).

According to a study, using the Valsalva Maneuver during venous cannulation significantly reduced pain. In the group that used the Valsalva Maneuver, 72% of patients experienced no pain, which was lower than the other groups where 100% of patients experienced some pain ($p < 0.001$). Additionally, all patients in the Valsalva group reported only mild pain, and none experienced moderate pain ($p < 0.001$).16 The median visual analog scale (VAS) score was significantly lower in the Valsalva group than in the control and ball groups ($p < 0.001$). These findings support our research results and further demonstrate the effectiveness of breath-holding in reducing pain intensity during an injection. Upon conducting a thorough analysis of

the P-values in our research and the literature, it became apparent that the likelihood of obtaining such an extreme result by chance was extremely low, providing strong evidence against the null hypothesis. (15, 16, 17). Thus, it can be concluded that there is a probable association between holding one's breath after deep inhalation and pain intensity while administering the injection. Overall, based on our literature review and research results, it is evident that holding one's breath after inhalation is a promising intervention for reducing pain during injection. (18, 19). The consistently lower mean pain scores observed in the intervention group and the statistically significant P-values provide compelling evidence for the effectiveness of this approach (20). In conclusion, holding one's breath after deep inhalation effectively reduces pain during injection. The results of our study and the literature review consistently demonstrate that breath holding significantly lowers the mean pain scores compared to the control group. This simple technique can provide a quick and easy way to alleviate pain and discomfort during medical procedures.

Conclusion

It is concluded that the intervention of breath-holding after a deep inhalation during injections effectively reduced pain associated with injections. The objective and subjective pain intensity were significantly lower in the research group compared to the control group. Moreover, when participants in both groups compared the pain intensity of the current injection with a previous injection where the intervention was not applied, a higher proportion of participants in the research group reported less pain, indicating that the intervention had a more significant impact in reducing pain intensity. These findings suggest that breath-holding after a deep inhalation may be a simple and non-pharmacological technique that can be employed to alleviate pain associated with injections, potentially improving the overall patient experience during medical procedures. Further research and replication of the study may be warranted to confirm these findings and explore the underlying mechanisms of this analgesic effect.

Recommendation:

To nurses and healthcare workers.

The study suggested that instructing patients to take a deep breath and hold it during injections or other painful procedures may reduce pain intensity. We recommend incorporating this simple technique into our practice to improve patient experience, minimize pain-related negative memories, and potentially alleviate pain. Communicate the benefits and provide clear instructions for holding breath, considering individual patient preferences and medical conditions.

To future researchers

In our research conducted in the emergency department, we encountered challenges in obtaining data from patients who declined to participate in the study due to their discomfort or health condition. Additionally, we observed that the recording of pain through facial expressions, particularly after Injections may introduce confounding variables that could be mistakenly attributed to the disease process or other factors affecting the patient's condition. Therefore, we recommend that future researchers consider conducting similar studies in more stable hospital departments to minimize these confounding variables and obtain more accurate results. By mitigating these limitations, we can improve the validity and reliability of the research findings in this domain.

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