Effect of Cryotherapy on Recovery Outcomes among Patients Undergoing Surgical Rhinoplasty

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Abstract

Background: Surgical rhinoplasty has many complications such as intraoperative bleeding, eyelid edema and ecchymosis, Post-operative pain and theses complication can lead to Post-surgical rhinoplasty dissatisfaction syndrome**. Purpose:** to examine the effect of cryotherapy on recovery outcomes among patients undergoing surgical rhinoplasty. **Design**: A quasi experimental research design was utilized. **Setting**: The study was conducted in the Plastic and Burn Surgery Department at Menoufia University Hospital (Emergency Hospital), Menoufia governorate, Egypt. **Sample:** A consecutive sample of 60 adult patients of both sexes who undergoing surgical rhinoplasty and fulfills the inclusion criteria was selected and assigned randomly into study and control group, 30 patients for each**. Instruments of the study**: five instruments were utilized in data collection; 1) A Structured Interviewing Questionnaire, 2) Intra-operative surgical field bleeding grading scale, 3) Visual Analogue Pain Scale, 4) The modified "Surgeon Periorbital Rating of Edema and Ecchymosis" questionnaire, 5) The Short Assessment of Patient Satisfaction. **Results**: The findings revealed that the study group achieved statistically significant improvement than control group regarding all the recovery outcomes after implementation of cryotherapy. **Conclusion**: Implementing the cryotherapy as perioperative nursing intervention among patients undergoing surgical rhinoplasty is effective as it reduces the intraoperative bleeding, reduces the postoperative pain, reduces the postoperative periorbital edema and ecchymosis as well as has a significant improvement of patient's satisfaction.

Keywords: cryotherapy**,** recovery outcomes, surgical rhinoplasty

Introduction

Rhinoplasty is a procedure that changes the appearance or the shape of the nose while enhancing or preserving the nasal airway. Rhinoplasty is the most commonly performed cosmetic procedures in the United States, more than 200,000 procedures reported annually. This procedure has increased in popularity in the United States and around the world because facial cosmetic enhancement has become more routine and socially acceptable **(Manahan, et al., 2021).**

There are two types of rhinoplasty; nonsurgical rhinoplasty and surgical rhinoplasty. The nonsurgical rhinoplasty is a medical aesthetic procedure in which injectable fillers, most commonly hyaluronic acid is used to alter the shape of person's nose without a surgery (**Kim, et al., 2021**). While, surgical rhinoplasty is an actual invasive surgical procedure that corrects the functionality of the nose as well as its appearance **(Fallahi, et al., 2021).**

Osteotomies are performed during surgical rhinoplasty are responsible for a significant amount of intraoperative and postoperative complications. Trauma to angular vessels during osteotomy and

inadequate local hemostasis result in excessive intraoperative bleeding that decreasing the surgeon's view of the surgical field with causing more trauma to the surrounding tissues, increasing surgical time, risk of morbidities, and increase prolongation of the postoperative recovery period so surgical rhinoplasty is an exciting and challenging surgical procedure that is associated with different complications like intraoperative bleeding, postoperative pain, periorbital edema and ecchymosis that lead to post-surgical rhinoplasty dissatisfaction syndrome **(Heilbronn, et al., 2020).**

Early postoperative edema and ecchymosis are the most common factors to complicate initial patient perceptions about rhinoplasty and have negative impact on the final cosmetic outcome of the surgical procedure. In particular, these complications are associated with delayed post-surgical recovery and achievement of the definitive aesthetic result, with high levels of dissatisfaction reported by the patients (**Bautista, et al., 2021**).

Post-operative pain, one of early complication of surgical rhinoplasty and remains a concern and a possible deterrent to surgery for prospective patients. It ranges from negligible to moderate and is seldom severe. Postsurgical rhinoplasty pain usually last for 36 to 72 hour **(Meraj, et al., 2020; Namin, et al., 2020).**

Moreover, many patients express various emotions such as worry, anxiety and even anger when observing the postoperative changes which are usually normal to happen. "Post-surgical rhinoplasty dissatisfaction syndrome" may be the most predominant problem in this regard **(Tseng, et al., 2021).**

So in this regard, the recovery outcomes among patients undergoing surgical rhinoplasty should be managed. The nurses should do their best to alleviate patient's postoperative pain, intraoperative bleeding, periorbital edema and ecchymosis and improving patient satisfaction through using non pharmacological methods as application of cryotherapy. Cryotherapy is the general or local use of low temperatures in medical treatment. It is the simplest and most commonly used method for treatment of acute tissue injury **(Kwiecien & McHugh, 2021) .**

Nowadays, cryotherapy may be applied by using different forms of ice as frozen gel packs, or by evaporation of volatile fluids from the skin**.** The way which ice is applied will vary according to the required effects. It may be applied in the form of immersion, ice cube massage, ice packs, ice spray, cold compression units **(Chen, et al., 2021).**

The cryotherapy is considered cost effective method, easy to apply, it is more locally used in the desired location and can be repeated without complications. Due to utilizing coldness in cryotherapy, vasoconstriction occurs and consequently less bleeding. Authorities have explained the effect of cold therapy in reducing periorbital edema and ecchymosis post-surgical rhinoplasty helping patients adjusting the new appearance, psychologically when have a partial view of new nose **(Gruber, et al., 2017).**

Significance of the study

Surgical rhinoplasty ranks in the top of most common cosmetic procedures worldwide. According to the American Society of Plastic Surgeons (2019) reported that, in 2019, 821,890 surgical rhinoplasty procedures were performed worldwide, and 39.330 rhinoplasty procedures were performed in United States. According to Menoufia Statistically hospital record (2020) stated that about 80 surgical rhinoplasty procedures were performed in 2020.

Surgical rhinoplasty may cause some complications as intraoperative bleeding, post-operative pain, periorbital ecchymosis and edema that lead to postsurgical dissatisfaction expressed by patients related to these complications **(Koc, et al., 2017).** Empirical observation in Menoufia University hospital indicated an increased occurrence of these complications among patients undergoing surgical rhinoplasty. Also limited researches have been found to determine the effect of cryotherapy on these complications. So it is hoped that the present study opens the door for

evidence based practice to examine the effect of cryotherapy on intraoperative bleeding, pain, postoperative edema and ecchymosis as well as patient's satisfaction among patients undergoing surgical rhinoplasty.

Purpose of the Study

The purpose of the current study is to examine the effect of cryotherapy on recovery outcomes among patients undergoing surgical rhinoplasty.

Definition of Variables

Cryotherapy: is theoretically defined as cold therapy which is a technique where the body is exposed to extremely cold temperatures for several minutes. Cryotherapy can be delivered to just one area, or for the whole body **(Dykstra, etal., 2019).** In the current study, it is operationally defined as the application of a cold pad -5 ° C on periorbital area and back of the nose for 10 minutes hourly for 48 hrs.

Recovery outcomes: is theoretically defined as progress made by the individual on the recovery journey **(Mental Health Network, 2011).** In the current study, it is operationally defined as surgical outcomes which result from the surgical rhinoplasty including postoperative edema, ecchymosis, pain, intra-operative bleeding

Research Hypotheses

The following research hypotheses are formulated in an attempt to achieve the purpose of the study.

1- Patients undergoing surgical rhinoplasty who receive cryotherapy (Study group I) will have less intraoperative bleeding than patients who will not receive cryotherapy (Control group II).

2- Patients undergoing surgical rhinoplasty who receive cryotherapy (Study group I) will have less postoperative pain score than patients who will not receive cryotherapy (Control group II).

3- Periorbital ecchymosis in patients undergoing surgical rhinoplasty who receive cryotherapy (Study group I) will be improved more rapidly than in patients who will not receive cryotherapy (Control group II).

4- Periorbital edema in patients undergoing surgical rhinoplasty who receive cryotherapy (Study group I) will be improved more rapidly than in patients who will not receive cryotherapy (Control group II).

5- Patients undergoing surgical rhinoplasty who are receiving cryotherapy (Study group I) will be more satisfied than patients who will not receive cryotherapy (Control group II).

Methods

Research design:

A Quasi-experimental research design was used in the present study (study & control group).

Setting:

The present study was conducted in the plastic and burn surgery department which consists of two operating rooms, three rooms (16 beds), ICU room, storage and nursing station at the Menoufia University Hospital (Emergency Hospital), at Menoufia governorate, Egypt.

Study sample:

A consecutive sample of 60 adult patients of both sexes who undergoing surgical rhinoplasty and fulfill the inclusion criteria was selected and randomly assigned into two equal groups (study & control group), 30 patients for each**.**

- The study group (I) received application of cryotherapy starting from one hour preoperative, intraoperative and for 48 hours postoperatively while patient awake with usual hospital care.

- The control group (II) received usual hospital care.

The sample size was determined based on the review of past literatures by **Kaviani, et al., (2015)** "The impact of cryotherapy on reducing postoperative periorbital ecchymosis and nasal edema in patients undergoing rhinoplasty". Based on this results sample size was calculated at power 80%, margin of error 5% and confidence

interval 95%. The sample size was determined by using the following equation

$$\textbf{Sample size} = \frac{\left(Z(1-\frac{\alpha}{2})SD^2\right)}{d^2}$$

- Z = Z statistic for a level of confidence of 95%, which is conventional = 1.96.
- SD = Standard deviation.
- d = precision (in proportion of one; if 5%, d = 0.05)

So the calculated sample was 40 subjects and increased to 60 subjects to increase the power of the study.

Inclusion criteria:

Patients who undergoing surgical rhinoplasty, welcome to share in the study as well as aging 18–60 years old.

Exclusion criteria:

Patients with a previous surgical rhinoplasty procedure, patients with bleeding disorders were excluded as their condition interfere with the degree of intraoperative bleeding and affect the results as well as diabetic patients were excluded because their condition interfere with pain sensation and affect the results.

Instruments of the study

Instrument I: structured interviewing questionnaire: this instrument was developed by the investigator to assess socio-demographic characteristics and patients' knowledge. It includes two parts:

- **Part I: Socio-demographic data**: It consists of age, gender, residence, education, occupation, and monthly income.
- **Part II: Patients' Knowledge Assessment Sheet**: It was developed by the researcher based on literature reviews such as Borsting, etal. (2020), Heilbronn, etal., (2020) , Tasman, (2017) . It included series of questions to elicit patients' information related to the surgical procedure such as definition of rhinoplasty, indication of rhinoplasty, types and approaches of rhinoplasty, Preoperative instructions and postoperative care, the complications of rhinoplasty including the complications, how to deal with these complications, definition and action of cryotherapy and how cryotherapy can applied and self-care at home. It consists of eleven questions completed by the researcher based on patient response. Each question is rated in terms of whether the patient know complete correct answer = 2, know incomplete correct answer = 1, incorrect answer | don't know = 0. The final score range 0-22. Which 0-10 indicate poor knowledge, 11-16 indicate fair knowledge and 17- 22 indicate good knowledge. Reliability of the patients' knowledge instrument was tested by Cronbach's Alpha and it was found that r = 0.94.

Instrument II: Intra-operative surgical field bleeding grading scale: It was adopted from Wormald (2008). Intra-operative surgical field bleeding grading scale was applied during the operation to assess the intraoperative bleeding. It is an ordinal eleven points grading scale, from 0-6 which determines number of points of and 7-10 determine the severity of hemorrhage.

The grade of bleeding was assessed according to number of points of oozing such as (0=no bleeding, 1=1-2 points of oozing blood, 2=3-4 points of oozing blood, 3=5-6 points of oozing blood, 4=7-8 points of oozing blood, 5 = 9-10 points of oozing blood (sphenoid fills in 60 seconds) and 6 >10 points of oozing blood (sphenoid fills in 50 seconds) and the severity of bleeding was assessed regarding to the time at which the sphenoid fills with blood such as 7 = Mild bleeding/oozing from entire surgical surface with slow accumulation of blood in the post nasal space (sphenoid fills by 40 seconds), 8 = Moderate bleeding from entire surgical surface with moderate collection of blood in the post nasal space (sphenoid fills by 30 seconds)**,** 9 **=** Moderately severe bleeding with rapid collection of blood in the post nasal space (sphenoid fills by 20 seconds**)** and 10= Severe bleeding with nasal cavity filling rapidly (sphenoid fills in < 10 seconds)**.**

The reliability of instrument of intra-operative surgical field bleeding grading scale was tested by **Athanasiadis, et al., (2008)** who found that the test retest reliability was r = 0.84.

Instrument III Visual Analogue Pain Scale (VAS): It was adopted from **Bain, et al., (2005)** and to rate the subject's pain intensity level. The total score was from 0 to 10, in which zero mean indicated no pain while a score from 1 to 3 indicated mild pain, a score from 4 to 6 indicated moderate pain, a score from 7 to 9 indicated sever pain and 10 indicated worst pain. The reliability of the VAS was tested by **Boonstra, et al., (2008)** who found that the test retest reliability was r = 0.84 and reported that it had excellent test-retest reliability

Instrument IV: The modified "Surgeon Periorbital Rating of Edema and Ecchymosis (SPREE)" questionnaire: It was adopted from **Kara and Gökalan (1999)** and modified by Yücel (2005) to measure the degree of edema and ecchymosis find in the periorbital area postoperatively. The questionnaire was rated the degree of edema and ecchymosis on a 4-points scale: 1– 4 for edema and 0– 3 for ecchymosis. Edema scores were given depend on coverage of the iris with edematous eyelids, with 1 being no coverage; 2 indicated slight coverage of iris with swollen eyelid (mild), 3 indicated full coverage of iris with swollen eyelid (moderate) and 4 being full closure of the eye (sever). While ecchymosis scores were divided for the upper and lower eyelids, and furthermore into thirds for each eyelid, a score of zero indicated no ecchymosis present on either eyelid, and a score of 1 indicated that ecchymosis up to the inner one-third part of the lower and or upper eyelid (mild); a score of 2 indicated that ecchymosis up to the inner two-third part of the lower and or upper eyelid (moderate); and 3 indicated that at least two-thirds of the upper or lower eyelid was ecchymotic (sever). An individual score was given for each side for both edema and ecchymosis.

Reliability of the modified SPREE was tested by **Jeremie, et al., (2018)** who found that the intra-observer reliability of the instrument was r = 0.94 and it was considered excellent.

Instrument V: The Short Assessment of Patient Satisfaction (SAPS)*:* It was developed by **Hawthorne, et al., (2006)** and modified by researchers to meet the purpose of the current study. The short assessment of patient's satisfaction (SAPS) was a short, reliable and valid seven item scale that can be utilized to assess patient's satisfaction with their treatment. The items from all these patients' satisfaction scales were pooled and the SAPS developed by selecting the items with best measurement properties and the most comprehensive coverage of the domains of patient satisfaction. The SAPS had seven items for assessing the core domains of patient's satisfaction which consist treatment satisfaction, clinician care, explanation of treatment results, participation in medical decision making, time with the clinician, respect by the clinician, and satisfaction with hospital/clinic care. Responses scales were 5-point scales. The score range was from 0 (extremely dissatisfied) to 28 (extremely satisfied) and rated as the following:

a) 0 to 10 = Very dissatisfied
b) 11 to 18 = Dissatisfied

c) 19 to 26 = Satisfied
d) 27 to 28 = Very satisfied.

Reliability of SAPS was tested by Sansoni, et al., (2011) by Cronbach's alpha and it was shown that r = 0.85.

Ethical considerations:

A written approval from the ethical and research committee was obtained to carry out the study, then an official letter from Menoufia faculty of nursing was delivered to the responsible authorities of Menoufia University Hospital (Emergency hospital) and to hospital administrators and the head nurses of plastic and burn surgery department to obtain written approval to conduct the current study from them. All patients were informed of the purpose of the study and their rights that they were free to decide whether or not they would participate in the study. Then a written informed consent was obtained from each patient. Confidentiality was ensured by not sharing the information linked to the participants' names with other individuals.

Data collection

Validity of the instruments:

All instruments were tested for content validity by five experts in the medical, surgical fields including (teaching staff members and plastic and burn specialists) to ensure completeness and relevance after that modifications were done accordingly.

Pilot study

A pilot study was carried out on 6 patients (10%) in order to test clarity, feasibility and applicability of the instruments. The pilot study was also used to estimate the time needed for each subject to fill in the questions. Modifications were done depend on the results of the pilot study. Patients participated in the pilot study were excluded from the main study sample.

Procedure:

❖ Official letter from the faculty of nursing was delivered to the responsible authorities of the hospital (the hospital chief executive and the director of the plastic and burn surgery department). The data collection was started from the first of January to the end of august 2021.

❖ Formal written consent was obtained from the patient after explanation of the purpose of the study for participation. Confidentiality and privacy were assured through coding the data.

❖ At the beginning of the study, each subject of both groups was interviewed individually and assessed for socio-demographic data using instrument 1 part 1.

❖ All subjects of both groups were assessed for their knowledge about the surgical procedure including definition and incidence of rhinoplasty, indications of rhinoplasty, types and approaches of rhinoplasty, preoperative instructions and postoperative care, the complications of rhinoplasty including how to deal with these complications, definition and action of cryotherapy and how cryotherapy can be applied and self-care at home by using instrument 1 part 2.

❖ The researcher described the visual analogue pain scale for each subject prior to the surgery.

The control group

o The control group was received the routine hospital care.

o The researcher assessed the intraoperative bleeding using instrument II for each subject of the control group.

o The researcher assessed the postoperative pain and recorded at 1, 6, 24 and 48 hours postoperatively for each subject of the control group using instrument III.

o Postsurgical edema degree and ecchymosis were observed and recorded at 1, 6, 24 and 48 hrs. postoperatively using instrument IV for each subject of the control group.

o All subjects of control group were assessed for their knowledge after 48 hrs. of the surgery using instrument1 part 2.

o All subjects of control group were assessed for their satisfaction after 48 hrs. of the surgery using instrument V.

The Study group

• Only the study group was received an application of cryotherapy using cold pad as perioperative treatment for 10 minutes starting from one hour before the surgery until 48 hrs. postoperatively.

• While the patient was fully under care, the cold pad with a temperature of -5 ° C was applied to two sides of the patient's face and the back of the nose an hour before the surgery and during the surgery after the acceptance of the surgeon, when the pad temperature shown through a thermometer installed on the pad came up, it was replaced by a new one with a temperature of -5 ° C. The temperature was

maintained between -5 to 5 ° C to preserve the coldness longer.

- The researcher assessed the intraoperative bleeding for each subject in the study group using instrument II.

- The researcher assessed the postoperative pain and recorded at 1, 6, 24 and 48 hrs. postoperatively for each subject in the study group using instrument III.

- Postsurgical edema degree and ecchymosis were observed and recorded at 1, 6, 24 and 48 hrs. postoperatively for each subject in the study group using instrument IV.

- All subjects of study groups were assessed their knowledge after 48 hrs. of the surgery using instrument 1 part 2.

- Each subject in the study group was assessed for satisfaction after 48 hrs. of the surgery using instrument V.

❖ Then the comparison between study group and control group were done

Statistical analysis of the data

Data was fed to the computer and analyzed using IBM SPSS software package version 20.0. Quantitative data was described using mean and standard deviation and range (minimum and maximum). Qualitative data was described using numbers and percentage. Significance of the obtained results was judged at the 5% level. Two types of statistics were done:

I. Descriptive statistics:

They were expressed as mean and standard deviation (X+SD) for quantitative data or number and percentage (No & %) for qualitative data.

II. Analytic statistics:

➢ **Student t-test** used for normally quantitative variables, to compare between two studied groups.

➢ **Mann Whitney test** used for abnormally quantitative variables, to compare between two studied groups.

➢ **Chi-square test used** for categorical variables, to compare between different groups.

➢ **Fisher Exact Test** Correction for chi-square when more than 20% of the cells have expected count less than 5.

Results

Table 1 shows patient's socio-demographic data among both the study and control groups. It reveals that the age was ranged from 20 to 45 in both groups with a mean value of 27.90±6.514 in study group while 28.00±7.105 in control group. Regarding sex, both groups had the same ratio of male: female 46.7%, 53.3% respectively. Concerning residence, more than half of both group were from rural place (56.7%, 63.3% respectively). As regards the educational level, the 60% of patients in study group had high education but the 43.3% in control group had secondary school education. Regarding occupation, more than half of study groups were not working and more than two thirds of control group were not working (53.3% & 80.0% respectively). However, the majority of both study and control groups had enough monthly income (93.3%; 83.3% respectively). There were no statistically significant differences between study and control groups regarding to socio-demographic data.

Table 2 shows mean and standard deviation of total patients' knowledge score for the studied groups. It reveals that, the total patient's knowledge score in study group before intervention was ranged between 4 – 11 with a mean value of 7.10±2.123 and it was increased significantly to be after intervention 21.37±1.299 and was ranged from 17 to 22 score while in control group it was ranged between 4 – 10 before routine hospital care with a mean value of 6.50±1.656 and it was increased significantly after routine hospital care to be 9.23±3.530 with ranged from 4 to 17 scores. There were highly significant statistically differences between two studied group after intervention with better results in study group when it compared with control group. Also there were highly significant statistically differences between the study group

before and after intervention with P value <0.001 as well as control group.

Figure 1 shows that levels of patient's knowledge for both studied groups which reveals that the majority of both study and control group had poor knowledge before intervention (76.7% & 93.3% respectively). But after intervention, the majority (93.3%) of the patients in the study group had good knowledge while two thirds of the control group remain had poor knowledge (66.7 %).

Table 3 shows that patient's intraoperative bleeding. It reveals that, regarding the intraoperative bleeding in the study group, two thirds of patients (66.7%) had no bleeding, less than one third of patients (20%) had 1-2 points of oozing blood and only13.3% patients had 3-4 points of oozing blood while in the control group one third of patients (33.3%) had mild bleeding/oozing from surgical surface with slow collection of blood in the post nasal space (sphenoid fill in 40 seconds), less than one third of control group (26.7%) had moderate bleeding from entire surgical surface with moderate collection blood in the post nasal space (sphenoid fill in 30 seconds), only few of control group (16.7%) had moderately severe bleeding with rapid collection blood in the post nasal space (by 20 seconds) and only (6.7 %) patients of control group had severe bleeding with nasal cavity filling rapidly (sphenoid fills in <10 seconds). There were high significant statistically differences between study and control group the intraoperative bleeding with P value <0.001.

Table 4 shows patient's pain for studied group at several times interval (1, 6, 24, 48 hours) postoperatively. It reveals that, after 1 hour, in the study group more than two thirds (90%) had no pain while in control group more than two thirds (76.7%) had mild pain. After 6 hours, in the study group more than half (56.7%) had no pain while in control group more than two thirds (70%) had moderate pain. After 24 hours, in the study group about two thirds of study group (60%) has no pain and less than half of study group (40%) have mild pain while in control group two thirds of control group (66.6%) had moderate pain and one third (33.3%) had severe pain. After 48 hours, in the study group the majority of patients (93.3%) had no pain while in control group more than two thirds of control group (86.7%) had severe pain and less than one third (13.3%) have moderate pain. There were highly significant statistically differences between two group after1, 6, 24 and 48 hours postoperatively with P value <0.001.

Table 5 shows that distribution of Mean±S.D of pain for both studied group at several times interval. It reveals that the Mean±S.D of the study group after 1 hour 0.10±0.305, after 6 hours become 0.47±0.571 then increased after 24 hours to become 0.63±0.850 and finally decreased to 0.07±0.254. But in the control group, the Mean±S.D after 1 hour 1.97±1.189, after 6 hours become 4.43±1.25157 then increased after 24 hours to become 6.00±1.050 and finally also increased to become7.50±0.974 after 48 hours postoperatively. So it was reflecting the highly statistically significant differences between the study and control group after intervention as the study group had the lower Mean±S.D scores when compared with the control group.

Table 6 shows that patient's degree of edema (the right side) for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively. It demonstrates that the majority of the patients in study group had no edema in the right side at 1, 6, 24, 48 hours postoperatively (100%, 96.7 %, 83.3 % & 96.7 % respectively). While in the control group, more than two thirds of the patients (90%**)** had no edema after 1 hour postoperatively and after 6 hours, the majority of patients (93.3%) had mild edema. Moreover, the majority of the control group patients had moderate edema after 24 and 48 hours postoperatively (50.0 % & 73.3% respectively). There were highly significant statistically differences between study and control group according to patient's edema in the right side after intervention at 6,24 and 48 hours postoperatively with P value <0.001.

Table 7 shows that patient's degree of edema in the left side for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively. After 1 hour postoperatively, all patients (100%) of the study group have no edema. But in the control group, more than half of patients (56.7%) had no edema. After 6 hours postoperatively, more than two thirds of patients (86.7%) in the study group had no edema but in the control group, half of patients (50%) had mild edema. Moreover, after 24 hours postoperatively, in the study group, two thirds (66.6%) had no edema but in the control group, more than half of patients (80%) had moderate edema. After 48 hours postoperatively, in the study group, the majority (96.7%) of patients had no edema but in the control group, less than two thirds of patients (63.3) had moderate edema. There were highly significant statistically differences between study and control group concerning to patient's degree of edema in the left side after intervention at 1, 6, 24 and 48 hours postoperatively with P value <0.001.

Table 8 shows patient's degree of ecchymosis in the right side for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively. It shows that the majority of study group patients had no ecchymosis in the right side at 1, 6, 24, 48 hours postoperatively (100%, 96.7 %, 73.3 % & 93.3 % respectively). While in the control group, more than half of the patients (60%**)** had mild ecchymosis after 1 hour postoperatively, while after 6 hours and 24 hours postoperatively more than of the patients had moderate ecchymosis (60.0% & 60.0% respectively). In addition to, the majority of the control group patients had severe ecchymosis after 48 hours postoperatively (93.3%). There were highly significant statistically differences between study and control group regarding to patient's degree of ecchymosis in the right side after intervention at 1, 6, 24 and 48 hours postoperatively with P value <0.001.

Table 9 shows patient's degree of ecchymosis in the left side for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively. After 1 hour, all patients (100%) of the study group had no ecchymosis. But in the control group, more than half of patients (56.7%) had mild ecchymosis. After 6 hours, more than two thirds of the study group had no ecchymosis, but in the control group, less than two thirds of patients had moderate ecchymosis (73.3% & 63.3% respectively). After 24 hours, more than two thirds of the study group had no ecchymosis but in the control group, more two thirds of patients had severe ecchymosis (70% &76.7% respectively). After 48 hours, more than two thirds (86.7%) of the study group had no ecchymosis, but in the control group, (96.7%) of the patients of the control group had severe ecchymosis. There were highly significant statistically differences between both study and control concerning to patient's degree of ecchymosis in the left side after intervention at 1, 6, 24 and 48 hours with P value <0.001. **Table 10** shows patient's level of satisfaction. It reveals that the majority of the patients in the study group were satisfied but the majority of patients in the control group were dissatisfied (76.7% & 86.7% respectively). There were highly significant statistically differences between study and control group according to patient's level of satisfaction.

Figure 2 shows distribution of Mean±SD of patient satisfaction for both the studied groups. It shows that the mean value of the study group after intervention was 23.93±2.545 but the mean value of the control group was 14.57±2.285. This reveals that the study group subjects had the higher mean value of patient satisfaction after intervention as compared to the control group.

Table (1): Patient's Socio-demographic data

	Study Group n = 30		Control Group n = 30		Test of Sig.	P value
	No.	%	No.	%		
Age (years)						
Range	20-45		20-45		U=448.50	0.982^{ns}
Mean±S.D.	27.90±6.514		28.00±7.105			
Gender						
Male	14	46.7	14	46.7	FE=0.000	1.000^{ns}
Female	16	53.3	16	53.3		
Residence						
Rural	17	56.7	19	63.3	FE=0.278	0.792^{ns}
Urban	13	43.3	11	36.7		
Education						
Illiterate	0	0	1	3.3		
Read and Write	1	3.3	3	10.0		
Secondary	11	36.7	13	43.3	X^2=4.367	0.359^{ns}
High education	18	60.0	12	40.0		
Other	0	0	1	3.3		
Occupation						
Working	14	46.7	6	20.0	FE=4.800	0.054^{ns}
Not Working	16	53.3	24	80.0		
Monthly Income						
Enough	28	93.3	25	83.3	FE=1.456	0.424^{ns}
Not Enough	2	6.7	5	16.7		

Note: U= Mann Whitney test; x^2: Chi-square Test ; FE: Fisher Exact Test. Ns = not significant (p >0.05)

Table (2): Distribution of Mean and standard deviation of total patients' knowledge score.

Total patients Knowledge score	Study Group n=30		Control Group n=30		Test of Sig.	P value
	No.	%	No.	%		
Before						
Range	4-11		4-10		U=377.00	0.273^{ns}
Mean±S.D.	7.10±2.123		6.50±1.656			
After						
Range	17-22		4-17		U=3.000	<0.001*
Mean±S.D.	21.37±1.299		9.23±3.530			
U	0.000		218.00			
P value	<0.001*		0.001*			

U= Mann Whitney test

Figure (1): Levels of patient's knowledge for both studied groups.

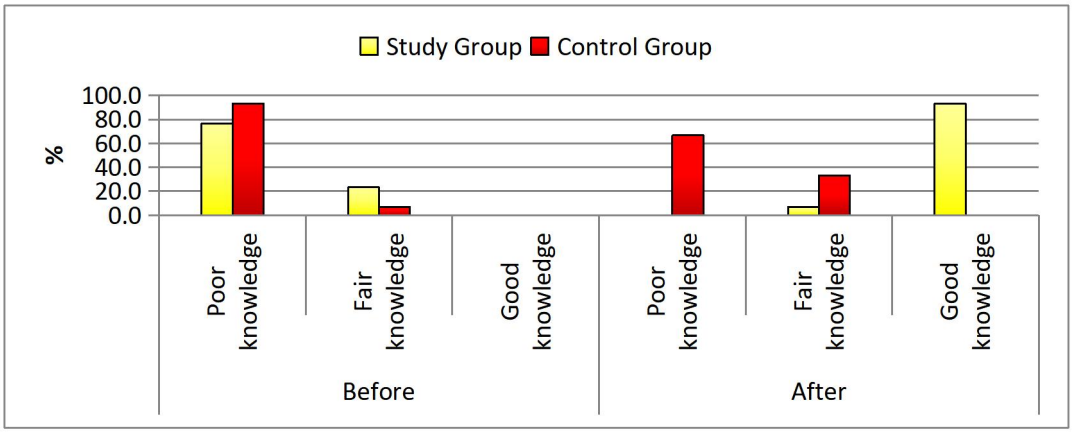

Table (3): Patient's intraoperative bleeding

Grading scale	Study Group n=30		Control Group n=30		X^2	P- value
	No.	%	No.	%		
Intraoperative bleeding						
No bleeding	20	66.7	0	0		
1-2 points of oozing blood	6	20.0	0	0		
3-4 points of oozing blood	4	13.3	0	0		
5-6 points of oozing blood	0	0	0	0		
7-8 points of oozing blood	0	0	1	3.3		
9-10 points of oozing blood (sphenoid fills in 60 seconds)	0	0	2	6.7		
>10 points of oozing blood, obscuring surface (sphenoid fills in 50 seconds)	0	0	2	6.7		
Mild bleeding/oozing from surgical surface with slow collection of blood in the post nasal (sphenoid fill in 40 seconds)	0	0	10	33.3	60.000	<0.001*
Moderate bleeding from entire surgical surface with moderate collection blood in the post nasal (sphenoid fill in 30 seconds)	0	0	8	26.7		
Moderately severe bleeding with rapid collection blood in the post nasal space (by 20 seconds)	0	0	5	16.7		
Severe bleeding with nasal cavity filling rapidly (sphenoid fills in <10 seconds)	0	0	2	6.7		

Table (4): patient's pain for studied group at several times interval (1, 6, 24, 48 hours) postoperatively.

	Study Group n=30		Control Group n=30		Test of Sig.	P value
	No.	%	No.	%		
After 1 hour						
- No pain	27	90.0	3	10.0		
- Mild pain	3	10.0	23	76.7		
- Moderate pain	0	0	4	13.3	X^2=38.585	<0.001*
- Severe pain	0	0	0	0		
- Worst pain	0	0	0	0		
After 6 hours						
- No pain	17	56.7	0	0		
- Mild pain	13	43.3	8	26.7		
- Moderate pain	0	0	21	70.0	X^2=40.190	<0.001*
- Severe pain	0	0	1	3.3		
- Worst pain	0	0	0	0		
After 24 hours						
- No pain	18	60.0	0	0		
- Mild pain	12	40.0	0	0		
- Moderate pain	0	0	20	66.7	U=60.000	<0.001*
- Severe pain	0	0	10	33.3		
- Worst pain	0	0	0	0		
After 48 hours						
- No pain	28	93.3	0	0		
- Mild pain	2	6.7	0	0		
- Moderate pain	0	0	4	13.3	U=60.000	<0.001*
- Severe pain	0	0	26	86.7		
- Worst pain	0	0	0	0		

Note: x^2=Chi-square; U = Mann -Whitney test

Table (5): Distribution of Mean ±S.D of pain for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively.

	Study Group n=30		Control Group n=30		Test of Sig.	P value
	No.	%	No.	%		
After 1 hour						
Range	0-1		0-4		U=61.50	<0.001*
Mean±S.D.	0.10±0.305		1.97±1.189			
After 6 hours						
Range	0-2		2-7		U=1.00	<0.001*
Mean±S.D.	0.47±0.571		4.43±1.251			
After 24 hours						
Range	0-2		4-8		U=0.00	<0.001*
Mean±S.D.	0.63±0.850		6.00±1.050			
After 48 hours						
Range	0-1		5-9		U=0.00	<0.001*
Mean±S.D.	0.07±0.254		7.50±0.974			

Table (6): Patient's degree of edema (right side) for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively.

SPREE (Right)	Study Group n=30		Control Group n=30		X^2	P value
	No.	%	No.	%		
After 1 hour						
- No edema	30	100	27	90.0	3.158	0.237^{ns}
- Mild edema	0	0	3	10.0		
- Moderate edema	0	0	0	0		
- Severe edema	0	0	0	0		
After 6 hours						
- No edema	29	96.7	1	3.3	16.596	<0.001*
- Mild edema	1	3.3	28	93.3		
- Moderate edema	0	0	1	3.3		
- Severe edema	0	0	0	0		
After 24 hours						
- No edema	25	83.3	0	0	52.271	<0.001*
- Mild edema	5	16.7	14	46.7		
- Moderate edema	0	0	15	50.0		
- Severe edema	0	0	1	3.3		
After 48 hours						
- No edema	29	96.7	0	0	30.594	<0.001*
- Mild edema	1	3.3	4	13.3		
- Moderate edema	0	0	22	73.3		
- Severe edema	0	0	4	13.3		

Table (7): Patient's degree of edema (Left side) for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively.

SPREE (Left)	Study Group n=30		Control Group n=30		X^2	P value
	No.	%	No.	%		
After 1 hour						
- No edema	30	100	17	56.7	45.263	<0.001*
- Mild edema	0	0	13	43.3		
- Moderate edema	0	0	0	0		
- Severe edema	0	0	0	0		
After 6 hours						
- No edema	26	86.7	5	16.7	46.667	<0.001*
- Mild edema	4	13.3	15	50.0		
- Moderate edema	0	0	10	33.3		
- Severe edema	0	0	0	0		
After 24 hours						
- No edema	20	66.7	0	0	56.800	<0.001*
- Mild edema	10	33.3	5	16.7		
- Moderate edema	0	0	24	80.0		
- Severe edema	0	0	1	3.3		
After 48 hours						
- No edema	29	96.7	0	0	60.000	<0.001*
- Mild edema	1	3.3	0	0		
- Moderate edema	0	0	19	63.3		
- Severe edema	0	0	11	36.7		

Table (8): Patient's degree of ecchymosis (right side) for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively

Ecchymosis (Right)	Study Group n=30		Control Group n=30		X^2	P value
	No.	%	No.	%		
After 1 hour						
- No ecchymosis	30	100	12	40.0	25.714	<0.001*
- Mild ecchymosis	0	0	18	60.0		
- Moderate ecchymosis	0	0	0	0		
- Severe ecchymosis	0	0	0	0		
After 6 hours						
- No ecchymosis	29	96.7	0	0	23.721	<0.001*
- Mild ecchymosis	1	3.3	12	40.0		
- Moderate ecchymosis	0	0	18	60.0		
- Severe ecchymosis	0	0	0	0		
After 24 hours						
- No ecchymosis	22	73.3	0	0	56.308	<0.001*
- Mild ecchymosis	8	26.7	1	3.3		
- Moderate ecchymosis	0	0	18	60.0		
- Severe ecchymosis	0	0	11	36.7		
After 48 hours						
- No ecchymosis	28	93.3	0	0	43.059	<0.001*
- Mild ecchymosis	2	6.7	0	0		
- Moderate ecchymosis	0	0	2	6.7		
- Severe ecchymosis	0	0	28	93.3		

Table (9): Patient's degree of ecchymosis (left side) for both studied group at several times interval (1, 6, 24, 48 hours) postoperatively.

Ecchymosis (Left)	Study Group n=30		Control Group n=30		X^2	P value
	No.	%	No.	%		
After 1 hour						
- No ecchymosis	30	100	13	43.3	56.444	<0.001*
- Mild ecchymosis	0	0	17	56.7		
- Moderate ecchymosis	0	0	0	0		
- Severe ecchymosis	0	0	0	0		
After 6 hours						
- No ecchymosis	22	73.3	0	0	56.400	<0.001*
- Mild ecchymosis	8	26.7	9	30.0		
- Moderate ecchymosis	0	0	19	63.3		
- Severe ecchymosis	0	0	2	6.7		
After 24 hours						
- No ecchymosis	21	70.0	0	0	60.000	<0.001*
- Mild ecchymosis	9	30.0	1	3.3		
- Moderate ecchymosis	0	0	6	20.0		
- Severe ecchymosis	0	0	23	76.7		
After 48 hours						
- No ecchymosis	26	86.7	0	0	60.000	<0.001*
- Mild ecchymosis	4	13.3	0	0		
- Moderate ecchymosis	0	0	1	3.3		
- Severe ecchymosis	0	0	29	96.7		

Table (10): Patient's level of satisfaction

Patient Satisfaction	Study Group n=30		Control Group n=30		Test of Sig.	P value
	No.	%	No.	%		
Very Dissatisfied	0	0	1	3.3	U=49.385	<0.001*
Dissatisfied	0	0	26	86.7		
Satisfied	23	76.7	3	10.0		
Very Satisfied	7	23.3	0	0		

U= Mann Whitney test

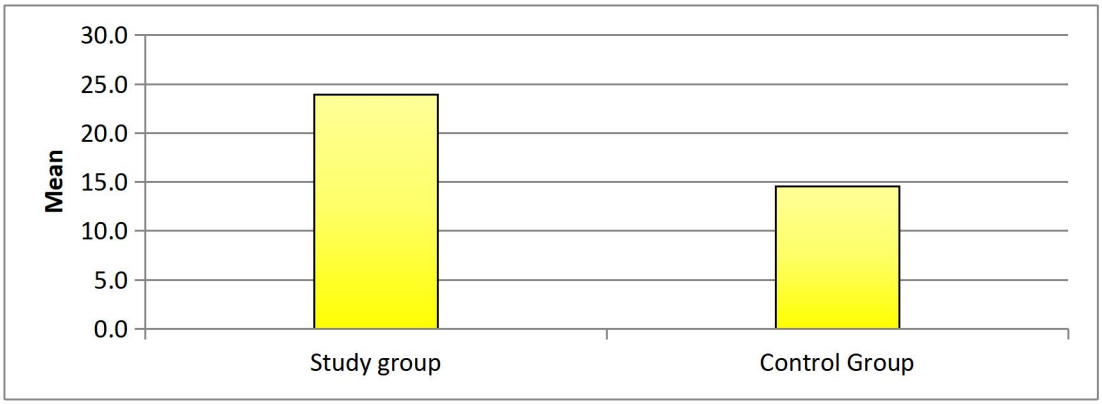

Figure (2): Distribution of Mean±SD of patient's satisfaction for both the studied groups.

Discussion

A good study is a study that creates or raises new ideas for further research and study. There was evidence of statistically significant improvement in the recovery outcomes among patients undergoing surgical rhinoplasty after application of cryotherapy as peri-operative nursing intervention **(kaviani, et al., 2015),** but to the best of our knowledge, only a few studies have addressed this issue. So, the primary focus of the current study is to determine the effect of cryotherapy on recovery outcomes among patients undergoing surgical rhinoplasty.

Regarding socio-demographic characteristics of the studied sample

Concerning the age

The findings of the present study revealed that both the study and control group were among the age group between 20 to 45 years old. From the researchers' opinion, the age between 20 to 45 years old represents the age of patients who undergoing surgical rhinoplasty because people in this age want to be beautiful and more attractive to other people. This finding was in the same line with **AlHarethy, et al., (2017)** who studied the "Assessment of satisfaction based on age and gender in functional and aesthetic rhinoplasty" and found that most of the patients were in the young adult group between 17 and 48years.

Also this finding coincides with **Santos, et al., (2019)** who studied the" Spare roof technique in reduction rhinoplasty: prospective study of the first one hundred patients" and found that most of the patients were in the adult group between 20 and 55years. The current study finding was in contrast with **Parsa, et al., (2021)** who studied the "role of age and gender on perception of women after cosmetic rhinoplasty" and found that most of the patients were in the young adult group between 25and 34years. And also on contrary with **Kazemy, et al., (2018)** who studied the "Complications of Rhinoplasty in Patients: An Epidemiological Study" and found that the majority of the subjects were within the age range of 18-25 years**.**

Regarding gender

The present study found that females are seeking to surgical rhinoplasty more than males. From the researchers' opinion, females are seeking to surgical rhinoplasty more than males because they have more facial beauty than men so they seek to repair any defect in their faces such as undergoing surgical rhinoplasty. The current finding was in the same line with **Kazemy, et al., (2018)** who found that the majority of the patients were females. But the present study was in contrast with **kaviani et al, (2015)** who studied the "Impact of Cryotherapy on Reducing Postoperative Periorbital Ecchymosis and Nasal Edema in Patients undergoing Rhinoplasty" and found that the same percentage for both females (50%) and males (50%) who seeking for performance of surgical rhinoplasty. .

Concerning the place of residence

The present study found that patients who undergoing surgical rhinoplasty from rural areas more than urban areas. This finding was agreed with **kaviani et al., (2015)** who found that patients who undergoing surgical rhinoplasty from rural areas more than patients who undergoing surgical rhinoplasty from urban areas. And it was in the same line with **Lee, et al., (2017)** who studied the "The effectiveness of postoperative intervention in patients after rhinoplasty: a meta-analysis" and found that patients who undergoing surgical rhinoplasty from rural areas more than patients who undergoing surgical rhinoplasty from urban areas.

But the finding of this study counteracted with **Belli, et al., (2013)** who studied the" Psychopathology and psychiatric co-morbidities in patients seeking rhinoplasty for cosmetic reasons" and found that patients who undergoing surgical rhinoplasty from urban areas more than patients who undergoing surgical rhinoplasty from rural areas**.**

Concerning the education

The findings of the present study revealed that the most of patients who undergoing surgical rhinoplasty had high education. From the researchers' opinion, patients who undergoing surgical rhinoplasty had high education because the majority of age ranged between 20:45 and this is the age at which people are seeking to surgical rhinoplasty. This finding was agreed with **Mehriar, et al., (2017)** who studied the "Mental Health of Rhinoplasty Applicants" and found that most of patients who undergoing surgical rhinoplasty had high education. Also with **Babuccu, et al., (2003)** who studied the "Sociological aspects of rhinoplasty" and found that most of patients who undergoing surgical rhinoplasty have high education. But the finding of this study counteracted with **Kazemy, et al., (2018)** who found that most of patients who undergoing surgical rhinoplasty had secondary school education**.**

In relation to the occupation

The current study found that most of patients who undergoing surgical rhinoplasty hadn't work. From the researchers' opinion, most of patients who undergoing surgical rhinoplasty hadn't work because most of them females who are housekeepers. This finding agreed with **Belli, et al., (2013)** who found that most of patients who undergoing surgical rhinoplasty unemployed. In the same line **Zakeri, et al., (2017)** who studied the" Study reasons and motives women tend to Rhinoplasty in Ardabil city" and found that most of patients who undergoing surgical rhinoplasty were housekeeper women and unemployed. But the finding of the current study counteracted with **Babuccu, et al., (2003)** who studied "Sociological aspects of rhinoplasty" and found that most of patients who undergoing surgical rhinoplasty had work. And also counteracted with **Alsubeeh, et al., (2019)** who studied the " Prevalence of considering revision rhinoplasty in Saudi patients and its associated factors" and found that most of patients who undergoing surgical rhinoplasty were employers.

Concerning the monthly income

The present study found that most of patients who undergoing surgical rhinoplasty had enough monthly income. This finding agreed with **Zakeri, et al., (2017)** who found that most of patients had enough monthly income. As well as,

Fatemi, et al., (2012) who studied the" Quality of life among Iranian adults before and after rhinoplasty" and found that most of patients who undergoing surgical rhinoplasty had enough monthly income. But the finding of this study counteracted with **Alsubeeh, et al., (2019)** who found that most of patients who undergoing surgical rhinoplasty had low monthly income.

Regarding the patient's knowledge

The present study found that there was great improvement in patients' knowledge after intervention in the study group when compared with patients' knowledge before the intervention and there were highly significant statistically differences in patients' knowledge scores between study group and control group. From the researchers' opinion, educating the patients who undergoing rhinoplasty by using information booklet about the surgical rhinoplasty procedure before surgery led to improvement of patients' knowledge about this surgical procedure and also led to improvement of patients' recovery outcomes.

This finding agreed with **Tseng, et al., (2021)** who studied the "Characterizing Patient Questions Before and After Rhinoplasty on Social Media: A Big Data Approach" and found that preoperative education of patients who undergoing rhinoplasty by using informational handout led to improvement of patients' knowledge about the surgical procedure and also led to improvement of patients' recovery outcomes.

In the same line **Hong, et al., (2009)** who studied the " Informed consent in rhinoplasty: prospective randomized study of risk recall in patients who are given written disclosure of risks versus traditional oral discussion groups" and found that the use of supplemental educational materials as written information during the informed consent process for patients who undergoing rhinoplasty enhanced postoperative recovery outcomes and satisfaction. But **Hakimi, et al, (2021)** who studied the" Development and Assessment of a Video-Based Intervention to Improve Rhinoplasty Informed Consent" found that the video informed them about rhinoplasty risks and benefits, effectively answered their questions and/or concerns and provided adequate information before surgery.

Regarding the intraoperative bleeding

The findings of the present study confirmed the hypothesis number (1) and revealed that the majority of the study group who received an application of cryotherapy had less intraoperative bleeding. From the researchers' opinion, the application of cryotherapy an hour before and during rhinoplasty surgery reduces the intraoperative bleeding due to its vasoconstrictive effect which produced when applied to the skin. This finding was agreed with **kaviani et al, (2015)** who found that application of cryotherapy an hour before and during rhinoplasty surgery was reduce the intraoperative bleeding.

This finding was also agreed with **Hyun, et al., (2021)** who studied the" The efficacy of hypotensive agents on intraoperative bleeding and recovery following general anesthesia for nasal surgery: a network meta-analysis" and found that there was great difference in intraoperative bleeding between study group and control group as the study group exhibited lower blood pressure and low intraoperative bleeding than control group and also added that the control of intraoperative bleeding contributes to successful surgery by improving visualization of the operating field. But the finding of this study counteracted with **Heilbronn, et al., (2020)** who studied the" Complications in rhinoplasty: a literature review and comparison with a survey of consent forms" and found that the percent of bleeding was 95%.

Regarding the postoperative pain

The findings of the present study confirmed the hypothesis number (2) which revealed that the majority of study group had no pain but more than two thirds of control group had severe pain. This finding was agreed with **kaviani et al, (2015)** who found that application of cryotherapy post rhinoplasty surgery was reduce the postoperative pain. In the same line **Kayiran, & Calli, (2016)** who studied the " The effect of periorbital cooling on pain, edema and ecchymosis after rhinoplasty: a randomized, controlled, observer-blinded study" and found that

cooling of the periorbital region reduced the postoperative pain after rhinoplasty surgery.

It was also supported by **Tasman, (2018)** who studied " Reducing periorbital edema and ecchymosis after rhinoplasty: literature review and personal approach" and found that postoperative cooling of the periorbital region reduced the postoperative pain after rhinoplasty surgery. Also **Apaydin, et al., (2018)** who studied the "Postoperative care in aesthetic rhinoplasty patients" and found that postoperative application of ice therapy reduced the postoperative pain after rhinoplasty surgery.

In contrast with **Dantas, et al, (2019)** who studied the " Short-term cryotherapy did not substantially reduce pain and had unclear effects on physical function and quality of life in people with knee osteoarthritis: a randomised trial" and found that there was no significant difference in reduction of pain severity between control and study group. And also, counteracted with **Hanci, et al., (2020)** who studied the "Evaluation of the efficacy of hilotherapy for postoperative edema, ecchymosis, and pain after rhinoplasty" and found that traditional ice application was not prevent the postoperative pain after rhinoplasty surgery.

Regarding the postoperative edema

The findings of the present study confirmed the hypothesis number (3) which revealed that the majority of patients in the study group had no edema. But in the control group, less than two thirds of patients have moderate edema and more than one third had severe edema. From the researchers' opinion, the application of cryotherapy postoperative rhinoplasty surgery was reduce the postoperative nasal edema due to the initial vasoconstriction effect which limits the extravasations of blood into the tissues following injuries. This finding was agreed with **kaviani et al, (2015)** who found that application of cryotherapy post rhinoplasty surgery was reduce the postoperative nasal edema. It was also supported by **Tasman, (2018)** who studied " Reducing periorbital edema and ecchymosis after rhinoplasty: literature review and personal approach" and found that postoperative cooling of the periorbital region reduced the postoperative nasal edema after rhinoplasty surgery.

In the same line **Kayiran, & Calli, (2016)** who found that cooling of the periorbital region reduced the postoperative nasal edema after rhinoplasty surgery. Also **Apaydin, et al., (2018)** who studied the "Postoperative care in aesthetic rhinoplasty patients" found that postoperative application of ice therapy reduced the postoperative nasal edema after rhinoplasty surgery. In contrast with **Hanci, et al., (2020)** who studied the " Evaluation of the efficacy of hilotherapy for postoperative edema, ecchymosis, and pain after rhinoplasty" and found that traditional ice application was not prevent the postoperative nasal edema after rhinoplasty surgery.

Regarding the postoperative periorbital ecchymosis

The findings of the present study confirmed the hypothesis number (4) which revealed that the majority of the study group has no ecchymosis. But in the control group, the majority of the patients have severe ecchymosis. This finding was agreed with **kaviani et al, (2015)** found that application of cryotherapy post rhinoplasty surgery was reduce the postoperative periorbital ecchymosis. In the same line **Kayiran, & Calli, (2016)** who studied the " The effect of periorbital cooling on pain, edema and ecchymosis after rhinoplasty: a randomized, controlled, observer-blinded study" and found that cooling of the periorbital region reduced the postoperative periorbital ecchymosis after rhinoplasty surgery.

Also **Apaydin, et al., (2018)** who studied the "Postoperative care in aesthetic rhinoplasty patients" found that postoperative application of ice therapy reduced the postoperative periorbital ecchymosis after rhinoplasty surgery. And this agree with **Tasman, (2018)** who studied " Reducing periorbital edema and ecchymosis after rhinoplasty: literature review and personal approach" and found that postoperative cooling of the periorbital region reduced the postoperative ecchymosis after rhinoplasty surgery. In contrast with **Hanci, et al., (2020)** who studied the "Evaluation of the efficacy of hilotherapy for

postoperative edema, ecchymosis, and pain after rhinoplasty" and found that traditional ice application was not prevent the postoperative ecchymosis after rhinoplasty surgery.

Regarding patients' satisfaction

The findings of the present study confirmed the hypothesis number (5) which revealed that the majority of patients in the study group were satisfied but the majority of patients in the control group were dissatisfied. From the researchers' opinion, the perioperative application of cryotherapy among patients undergoing surgical rhinoplasty improved their recovery outcomes as well as their knowledge related to the surgery and this led to high patients' satisfaction .This finding was agreed with **kaviani et al, (2015)** who found that application of cryotherapy post rhinoplasty surgery was reduce the complication related to surgery and led to increase patients' satisfaction.

In the same line **Kayiran, & Calli, (2016)** who found that cooling of the periorbital region reduced the postoperative periorbital ecchymosis after rhinoplasty surgery and led to high patients' satisfaction. And this agree with **Tasman, (2018)** who studied " Reducing periorbital edema and ecchymosis after rhinoplasty: literature review and personal approach" and found that postoperative cooling of the periorbital region reduced the postoperative complications after rhinoplasty surgery and led to increase patients' satisfaction. In contrast with **Hanci, et al., (2020)** who studied the "Evaluation of the efficacy of hilotherapy for postoperative edema, ecchymosis, and pain after rhinoplasty" and found that traditional ice application was not prevent the postoperative complication after rhinoplasty surgery and led to postsurgical rhinoplasty dissatisfaction syndrome.

In the end, considering the studies performed on the effect of cryotherapy; it has to be noted that application of cryotherapy is very effective nursing intervention in improvement of the recovery outcomes among patients who undergoing surgical rhinoplasty as, it is easy to apply, the patients can apply the cryotherapy for themselves, cost effective, it is applied locally in the desired location, can be repeated without complications.

Conclusion

Depend on, the obtained results of the present study, implementing cryotherapy as perioperative nursing intervention among patients undergoing surgical rhinoplasty improves the recovery outcomes for them. Implementing the cryotherapy as perioperative nursing intervention among patients undergoing surgical rhinoplasty is effective when providing care because it reduces the intraoperative and postoperative bleeding, reduces the postoperative pain, reduces the postoperative periorbital edema and ecchymosis and has a significant improvement of patient's knowledge and satisfaction.

The overall findings of the current study provide evidence to support the value of application of the cryotherapy as perioperative nursing intervention to improve the recovery outcomes among patients undergoing surgical rhinoplasty.

Recommendations

Depend on the findings of the present study, the following recommendations are derived and suggested:

1.Application of cryotherapy as perioperative nursing intervention should be done for all patients undergoing surgical rhinoplasty to improve their recovery outcomes.

2.Simplified booklet about surgical rhinoplasty, preoperative instructions, intraoperative and postoperative complications related to surgery, application of cryotherapy to reduce these complications and self-care at home should be available for patients undergoing surgical rhinoplasty.

3.The presence of educator nurse as a separate specialty in the plastic and burn department

to improve patient's knowledge about the surgical procedure should be considered. Nurses need to fulfill their roles as health educator for patients who undergoing surgical rhinoplasty.

4.Further studies with the application of cryotherapy as perioperative nursing intervention among patients undergoing surgical rhinoplasty should be done with large sample.

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