COLLEGE OF HEALTH SCIENCE, SCHOOL OF MEDICINE

DEPARTMENT OF ANESTHESIA

PREVALENCE AND ASSOCIATED FACTORS OF POST SPINAL ANESTHESIA TRANSIENT NEUROLOGICAL SYMPTOMS IN DESSIE REFERRAL HOSPITAL FROM FEBRUARY TO APRIL 2021, INSTITUTION BASED CROSS SECTIONAL STUDY.

INVESTIGATOR: SARA TIMERGA (BSC IN ANESTHESIA)

ADVISORS: WOSENYELEH ADMASU (BSC. MSC. ASSISTANT PROFESSOR)

TENBIT DANEL (BSC. MSC. LECTURER IN ANESTHESIA)

JULY 2021

ADDIS ABABA, ETHIOPIA

A THESIS SUBMITTED TO THE COLLEGE OF HEALTH SCIENCE, SCHOOL OF MEDICINE DEPARTMENT OF ANESTHESIA ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER OF SCIENCE IN ADVANCED CLINICAL ANESTHESIA.

Name of investigator	Sara Timerga
Name of advisors	Wosenyeleh Admasu Tenbit Danel
Full title of the research project	Prevalence and associated factors of post spinal anesthesia Transient neurological symptoms in Dessie referral hospital from February to April 2021, institution based cross sectional study.
Duration of project	February 1st 2020 – April 30th 2021
Study area	Dessie referral hospital, Dessie, Ethiopia
Total cost of project	24,079 birrs
Address of investigator	Tele; 251-925044807 Email: sara24tn@gmail.com

Declaration

I, the undersigned declare that this thesis is my original work in partial fulfillment of the requirements for the master of science degree in anesthesia. I understand that plagiarism will not be tolerated and all directly quoted material has been appropriately referenced

Name: _____

Signature: _____

Submission to MSc Tutor, Dept. Anesthesia, Addis Ababa University

Date of submission: _____

This thesis work has been submitted for examination with my/our approval as Advisors on the master of science degree in anesthesia.

Name signature

1._____ _____

2._____ _____

Abstract

Background: Spinal anesthesia is most commonly utilized regional anesthesia method for numerous surgical procedures. Spinal anesthesia has been an effective anesthesia method with an assessed success rate of over 90%. However, it has also been implicated as one of the possible causes of neurological complications following surgical procedures. Transient neurological symptoms (TNS) after spinal anesthesia that's characterized by postoperative discomfort within the buttocks or the lower extremities is one of the neurological complications with an estimated prevalence of 40%.

Objectives: The aim of this study is to determine the prevalence and associated factors of post spinal anesthesia transient neurological symptoms in Dessie referral hospital. Dessie, Ethiopia, February 1st 2021 – April 30th 2021.

Methods: An institutional based cross-sectional study design was used among patients who underwent surgery under spinal anesthesia in Dessie referral hospital from February 1st 2021 up to April 30th 2021. Sample size was calculated to be 215.The association between the dependent and independent variable was assessed by binomial and multiple logistic regression with p value of less than 0.5 considered as statistically significant.

Result: out of 215 patients that participated in our study and the prevalence of post SA TNS was observed to be 10.2%. Factors that were assessed to be associated with TNS were BMI (AOR = 2.9 and 95% CI: 1.03 - 8.43) and lithotomy surgical position (AOR =3.64 and 95% CI: 1.19 – 11.08).

Conclusion: our study result showed that the overall prevalence of post SA TNS in Dessie referral hospital is 10.2%. when compared with other studies the prevalence in our study is lower. BMI and lithotomy surgical position have significant relationship with the incidence of TNS.

Key words: post spinal anesthesia transient neurological symptoms, prevalence, associated factors, Ethiopia.

Acknowledgements

First, I would like to express my heart felt gratitude to my advisors Mr. Wosenyeleh admasu and Ms. Tenbit Daniel for their mentorship and assistance throughout the period of writing this thesis.

I would also like to appreciate Addis Ababa University, school of public health and medical sciences, Anesthesiology Department for giving me the opportunity to write this thesis.

Table of Contents

Lists of tables and figures

List of figures

Abbreviations and Acronyms

ASA: American Society of Anesthesiologists

BSC: Bachelor of Science

DRERC: Departmental Research and Ethics Review Committee

GA: General anesthesia

SA: Spinal anesthesia

MSC: Master of Science

NRS: numeric rating scale

NSAIDs: None-steroidal anti-inflammatory drugs

PACU: post anesthesia care unit

SPSS: statistical package for social sciences

TNS: Transient neurological symptoms

PDPH: Post Dural puncture headache

BMI: Body mass index

1. Introduction

1.1 Background

Spinal anesthesia is a central neuraxial blockade that results in a complete loss of sensation from the local anesthetics injected in to the subarachnoid space.[1] The first spinal anesthesia performed was in 1898 by august bier at royal surgical hospital of the Kiel Germany on a 34 years old male patient undergoing resection of tuberculous ankle joint, because he had suffered severe complications from previous general anesthesia. 15 mg of cocaine was administered intrathecally which decreased the complications previously seen from GA.[2] After this amylocaine, procaine, dibucaine and tetracaine were used for spinal anesthesia around the early 1990s. In 1945 lidocaine was used for spinal anesthesia for the first time and its short duration of action was favored for short procedures. Chloroprocaine was synthesized from procaine in 1946 and approved to be used for SA with its fastest onset and fastest resolution of block. Mepivacaine (1956) and prilocaine (1965) were also used for the first time with similar competency to lidocaine as a result are still on further studies to replace lidocaine for its association with TNS. In the 1960s bupivacaine was widely accepted for its long-acting effect but was also associated with toxicity which resulted in studies on levobupivacaine and ropivacaine initiated in 1999 for their intrathecal use.

Spinal anesthesia is commonly utilized anesthesia technique for surgical procedures. One of the main requirements for choosing the type of anesthesia to be used is how the patients recover postoperatively, how well, postoperative pain, nausea and vomiting, and urinary retention are controlled. These side effects are associated with delayed hospital discharge and unplanned readmission. Spinal anesthesia is also believed to have a better control of postoperative nausea and vomiting and a higher possibility of early discharge.[3] However Spinal anesthesia has been identified as one of the possible if not main causes of neurological complications following surgical procedures.

Following spinal anesthesia some neurological complications might occur. Low back pain, headache, PDPH, and pain arising from the lower back radiating to the bullocks and lower extremities. This clinical manifestation of pain in the buttocks and lower extremities now called Transient neurological symptoms were first published as a case reported by

Schneider In 1993, which was a transient pain and usually fading away within 24-48 hours.[4] The pain was mostly assessed to be starting from lower back radiating to the buttock and lower extremities. These major symptoms which are currently known as transient neurologic symptoms their cause is not well known yet. Currently TNS is defined as a pain or discomfort of the buttocks and thighs with risk of possibly radiating to the lower extremities, and believed to have begun within a few hours after spinal anesthesia and lasting as long as ten days. Pain is also assessed to range from mild to severe. Transient neurological symptoms (TNS) after spinal anesthesia is also characterized by postoperative discomfort or dysesthesia in the buttocks and lower extremities.[5]

Few studies attributed TNS to the drug used intrathecal. The most significant risk factors associated with the development of TNS is lidocaine which is commonly used local anesthetics. However, there are other studies that have stated on other factors contributing for this post spinal complication development.

1.2 Statement of the problem

Spinal anesthesia has been a better alternative anesthetic technique that provides a better mortality and morbidity outcome than general anesthesia but the post spinal neurological complications that are being reported have resulted in the decrement of its quality. This complications have been associated with an increase in post-operative hospital stay, pain ranging from mild to severe and discomfort associated with it, the increased likelihood of spinal anesthesia refusal and dissatisfaction.[6] Out of this postoperative complications TNS is also known to be contributing to this outcomes.

Transient neurological symptom is a neurological complication manifested by lower back pain, pain at the buttocks and the thigh that might radiate to the lower extremities occurring post spinal anesthesia with in the first 24 – 48 hours and recovery completely achieved within the 10 day or less.[7] The pain is expected to be bilateral symmetrical of lower back and buttocks with radiation to both lower extremities.[8] It is named transient since there is complete recovery from symptoms within 1 week after spinal anesthesia. The pain is usually described as mild to moderate and aching character. It is not followed by any motor, sensory, or sphincter function loss or signs that are of meningeal irritation.[9]

The incidence of these transient neurological symptoms following spinal anesthesia has been reported to range from 10% to 37%[10-13]. The pathology of TNS is unclear and there is controversy as to whether it is neurotoxicity or myofascial pain resulting from musculoskeletal strain. Even though cause of this complication is not known the factors attributing to its development have been described. The choice of drug used intrathecally mainly lidocaine was shown as a main risk factor as there were studies that showed incidence of TNS as high as 40% when lidocaine was used for spinal anesthesia. [10, 14] The position for the surgical procedure typically lithotomy position was seen having higher risk of than supine (R.R=4.1) (95% CI -3.0-4.9) [10], early mobilization after surgery was also stated as a risk for developing TNS[12]. This complication is also associated with patient refusal of spinal anesthesia.

Since TNS is believed to be associated with lidocaine there was suspicion that TNS could be caused by toxicity from the drug and lidocaine having shown rapid neurological damage in animal models without recovery of normal function [15] but in TNS cases the symptoms were seen with delayed onset and full recovery from symptoms.[16] There was also no difference in the incidence of TNS between different concentration and doses used for spinal anesthesia [17, 18] which indicated that TNS was not caused by toxicity.

2. Literature review

Transient neurological symptom case was first reported in 1993 by scheinder as a pain that stars from the lower back and radiates to the buttock and lower extremities appearing first with in the first 24-48 hours post spinal anesthesia and subsiding without any permanent neurological damage to the patient. It was named transient radicular irritation and changed to transient neurological symptoms later on [9].

The pain experienced in the buttocks and lower extremities is different from Lower back pain post recovery from spinal anesthesia, which has since been characterized as 'transient neurological symptoms'. Studies that include different concentrations and doses of lidocaine have shown that the risk of developing TNS was not associated with dose or concentration [11, 19, 20]. This shows no evidence of localized nerve damage as the cause for the symptoms and All forms of lidocaine have also been associated with TNS: hyperbaric[19] ; isobaric [20]; and when diluted with cerebrospinal fluid[21]. The causes of this new painful complication are still unknown. Possible causes of TNS that have been hypothesized include a specific local anesthetic toxicity[22, 23], needle trauma, neural ischemia secondary to sciatic nerve stretching derived from an experiment done using a frogs sciatic nerve exposed for 15 min with 5% lidocaine showing not recovery from the conduction block[4], pooling of local anesthetics secondary to small gauge pencil point needles[11], muscle spasm, myofascial trigger points, early mobilization, or irritation of the dorsal root ganglion[24]. As few patients receiving intrathecal bupivacaine report TNS, it appears that TNS is not the result of having a subarachnoid block. consequently, outlier of subarachnoid block (spinal needle placement, position and surgery) are not the sole causal factors for TNS.[5]

In previous studies conducted, the incidence of transient neurological symptoms following spinal anesthesia has been reported to range from 10% to 37%[9, 11, 25, 26]. On a recently published study conducted in Sina hospital Tehran University of medical science, Tehran, Iran the incidence of transient neurological symptom have been reported as 39.6% [10].

lidocaine was stated to have a high association with the risk of developing of post spinal anesthesia TNS than other local anesthetics.[13] Most of the studies conducted on TNS

are comparative studies comparing the incidence with lidocaine and other local anesthetics almost all showed higher incidence with lidocaine than other local anesthetics.[13]

In a randomized control trial conducted about the incidence of TNS in lidocaine and levobupivacaine comparable groups with 60 patients (13 female, 47 male overall mean age 30 years) by M. GOZDEMIR in Turkey Ankara Fatih University School of Medicine, in 2009 the incidence of TNS in was significantly higher (26.6%) in lidocaine group than levobupivacaine group (3.33%)[20]. On a comparative study between isobaric lidocaine and prilocaine conducted by K. De Weert in 2001 the incidence of TNS was 20% in lidocaine group while in prilocaine group none of the participants developed TNS[27]. In another study conducted by R Martínez-Bourio in 1998 comparing lidocaine and prilocaine with 200 participants on the incidence of TNS although both showed low incidence prilocaine had lower (1%) incidence than lidocaine (4%)[28]. Even though TNS is mostly seen in lidocaine spinal anesthesia there has been a randomized control trial conducted by J Philip in 2001 with study participants of 58 that showed incidence of transient neurologic symptoms with lidocaine as 3% (95% confidence interval = 0.1%-17.8%) while in bupivacaine was 7% (95% confidence interval = 0.9%-23.5%), (P = not significant)[29]. We cannot completely attribute TNS to lidocaine since it has also been seen in other local anesthetics.

There have been studies that have tried to determine other associated factors related with TNS beside the drug type used and it seems that TNS development could be multi-factorial and other parameters, besides the type of drug used for spinal anesthesia, can be attributed for aggravating or producing these symptoms [10]. In a study conducted by Farhad Etezadi Iran, Tehran, Iran University of Medical Sciences (IUMS), comparing incidence of TNS by local anesthetics (lidocaine and bupivacaine), needle type (Sprotte or Quincke), and surgical position (lithotomy and supine) with 250 candidates of elective surgeries. it showed that TNS is significantly higher in lidocaine group (68%) than bupivacaine group (11%), needle type had no statistical relationship in incidence of TNS and lithotomy position was highly associated with TNS than supine surgical position.[10] The lithotomy position is associated with TNS because It is suspected to have increased

the vulnerability of nerve fibers exposed to lidocaine by stretching lumbosacral nerve roots[11]. Use of a double-orifice spinal needle was found to be associated with a lower incidence of TNS based on a comparative study between two different types of pencil-point spinal needles: two-orifice (Eldor) and one-orifice (Atraucan) spinal needles based on the study conducted by Shmuel Evron in 2007[14]. In a study conducted in Akdeniz University Faculty of Medicine, Antalya, Turkey by Zübeyde Ateş Çetin the incidence of TNS was 37.5% with a significantly higher incidence in gynecologic and urologic surgeries (probably associated with the surgical position) and female patients.[30] Patients undergoing spinal anesthesia were kept recumbent for 24 hours to prevent post Dural puncture headache. But it was shown as not having any reduction in the incidence as a result the time of ambulation taken after spinal anesthesia gradually changed from 24 h to the time that the effects of spinal anesthesia have worn off. Early ambulation, as opposed to 24 h recumbency, therefore represents one of the most dramatic changes in the practice applied during use of spinal anesthesia. Study conducted by B. G. Cramer in 2005 to assess the effect of early mobilization on incidence of TNS but it showed that there was no significant relationship between early mobilization and incidence of TNS[12]. J M Freedman conducted epidemiological study on 1863 patients in 1998 to assess the incidence of TNS and its associated factors and the study showed higher incidence of TNS in lidocaine (11.9%) and bupivacaine (1.3%), the relative risk of transient neurologic symptoms was 2.6 (95% CI, 1.5 to 4.5) with the lithotomy position compared with other positions, 3.6 (95% CI, 1.9 to 6.8), for outpatients compared with inpatients, and 1.6 (95% CI, 1 to 2.5) for obese (body mass index >30) compared with nonobese patients.[11]

In most of the patients developing TNS it is unlikely to be diagnosed and treated since most of the patients are discharged before the symptoms develop and most patients don’t seek medical attention since the symptoms are mild. Pharmacologic treatments for this neurologic pain include NSAID, opioids, and nonopioid analgesics. In a case report presented by Pirbudak Cacelli in 2009 Epidural steroid treatment was believed to be effective in the patient with TNS that were resistant to treatment with amitriptyline, NSAIDs and gabapentin[31].

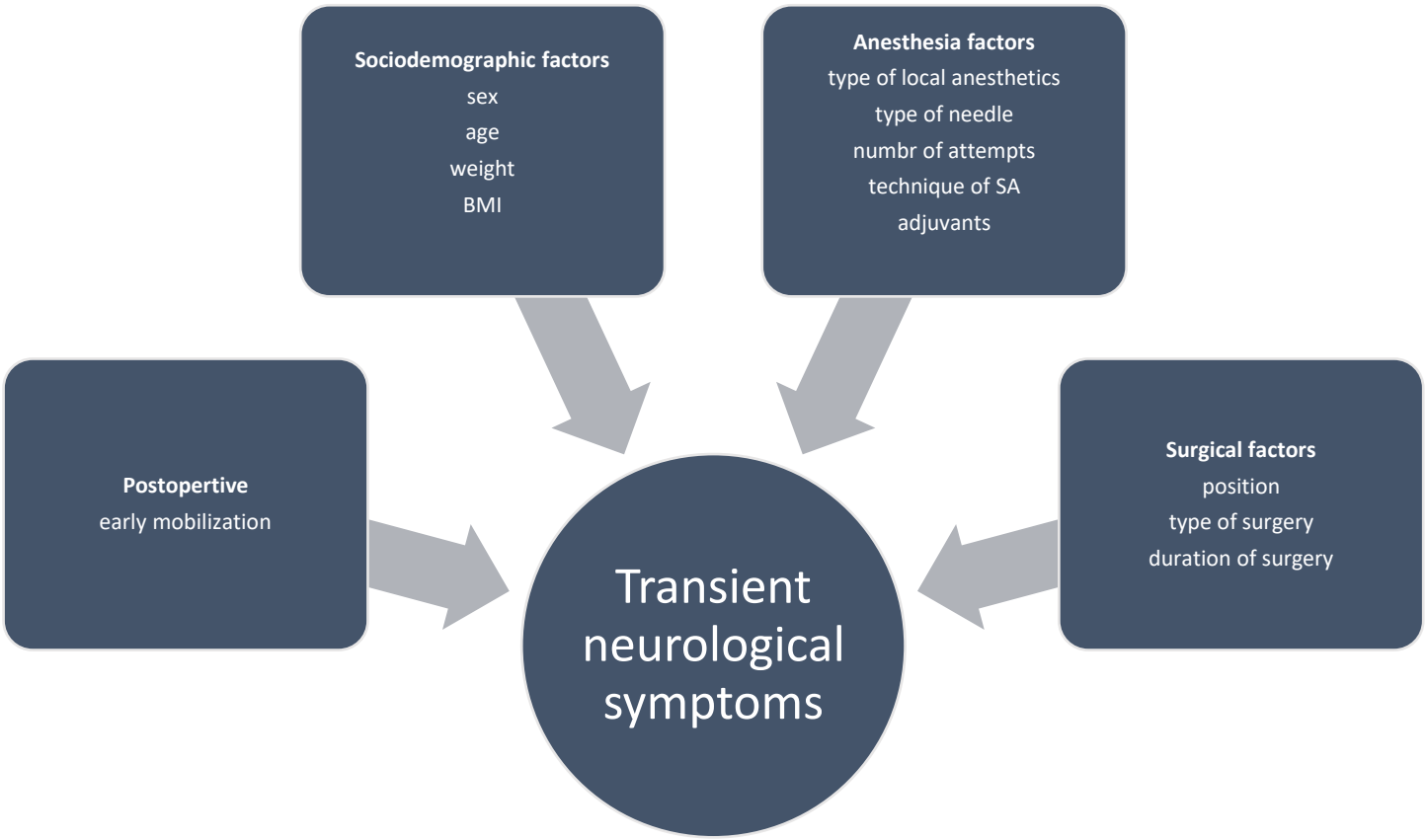


Figure 1 conceptual framework of Transient neurological symptoms and associated factors

3. Justification

Spinal anesthesia has been termed as a better and safer anesthesia technique for those undergoing surgery and although it is not without complication of its own most of the complications are explained and for the most part understood, meanwhile TNS which is expected to have more than 30% of incidence has not been fully understood. Even though some of the factors associated with TNS have been identified there is still not enough information on the causes of this complication. There is a need for further study of the problem.

Spinal anesthesia is a widely used anesthesia techniques in Ethiopia for its simple application and limited complications. Nevertheless, there is a high rate of patient refusal and dissatisfaction of spinal anesthesia due to its postoperative complications. This study is important to assess the incidence of TNS which could be un unknown contributing factor for dissatisfaction and patient refusal. Based on the search we conducted there are no studies conducted on the prevalence or associated factors of TNS in Ethiopia hence, the prevalence of TNS in our country is not known. The studies conducted in other parts of the world cannot be representative of the population in Ethiopia because of a large difference in the anesthesia practice. The local anesthetics used with their dose and concentration, type of needles used and size, higher number of SA attempts correlating with skills, significantly lower follow up of patients postoperatively, demographical characteristics and prolonger surgical procedures all of which could be un unknown contributing factors for TNS development are some of this practical differences. I expect to find higher incidence of TNS as the poor anesthesia practice has exposed patients in Ethiopia to have a higher chance of developing post spinal anesthesia complications like postoperative nausea and vomiting[32], PDPH [33] and backpain.[34]

The aim of the study to be conducted is to assess the incidence of TNS and its associated factors by assessing the incidence of TNS allows us to know the weight of the problem we will be dealing with, understand the associated factors allows us to determine a better alternative choice of anesthesia for those patients that are susceptible to develop TNS. Treatment of these complication can be easy when the causes and risk factors are known. All of this allows us to be able to decreases the hospital stay of these patients by clearly

identifying the symptoms and treat them as such in their home. If there are any associated factors that could be prevented identifying them and using them as a guide for future spinal anesthesia practice.

Proper communication of this complication with susceptible patients preoperatively a reassurance of the patients to avoid postoperative confusion and dissatisfaction can be employed if these susceptible patients are properly identified and this research is aimed at identifying them. This study could also be used as a stepping stone for further analysis of this post spinal anesthesia complication.

4. Objectives

4.1 General objectives

To assess the prevalence and associated factors of post spinal anesthesia transient neurological in patients undergoing surgery in Dessie referral hospital, Dessie, Ethiopia from February to April 2021.

4.2 Specific objectives

1. To assess prevalence of post spinal transient neurological symptoms in patients undergoing elective surgery in Dessie referral hospital Dessie, Ethiopia from February to April 2021.
2. To determine the factors associated with post spinal anesthesia transient neurological symptoms in patients undergoing elective surgery in Dessie referral hospital Dessie, Ethiopia from February to April 2021.

5. Methods and material

5.1 Study Area and Study Period

The study was conducted in Dessie Referral Hospital from February 1st 2021 to April 30th 2021. It is located in Dessie town which is 401km away from Addis Ababa. It has about 749 workers from this 548 are health professionals and 201 administrative staffs serving in hospital. Out of those health professionals, 332 were nurses and 15 anesthetists with a total of 242 Beds. There are 7 surgical specialties pediatrics, gynecology and obstetrics, urology, neurosurgery, general surgery, orthopedics and plastic surgery. 133 patients undergo surgical procedures under spinal anesthesia per month.

5.2 Study Design

An institutional based cross-sectional study design was employed in Dessie referral hospital from February 1st to April 30th.

5.3 Population

1. Source of Population

All patients who underwent surgical procedure under spinal anesthesia in Dessie referral hospital from February 1st to April 30th

2. Study Population

All ASA I and ASA II who underwent surgical procedure under spinal anesthesia in Dessie referral hospital from February 1st to April 30th

5.4 Eligibility Criteria

1. Inclusion Criteria

All with ASA I and ASA II patients who underwent surgery under spinal anesthesia

2. Exclusion Criteria

Patients with history of acute and chronic back pain

Patients with neurological diseases

Patients with diabetes mellitus

5.5 Sample Size

1. Sample size determination

Interval = N/n = $399/215$ = 1.85 = 2

N = estimated target population in the study period

n = final sample size

Sample size was determined using the single population proportion formula by assuming the prevalence as 0.5 and 5% margin of error at the 95% confidence interval using the following formula:

$$n = \frac{z\alpha/_2\, p(1-p}{d^2}$$

Where n = sample size, z = 1.96, p =0.5, d = 0.05, CI = 95%,

And α= 5%.

$$n = \frac{1.96^2 \times 0.5(1-0.5)}{0.5^2} = 384$$

Where nf = n/ (1 + n/N) in which N = 399 (estimated target population in the study period).

So nf = 384/1.96 = 196

We added 10% of nf for the non-response rate (i.e., 196+ 19 =215). Therefore, a total sample size of 215 patients undergoing surgery under spinal anesthesia participated in this study.

2. Sampling technique

Systematic random sampling technique was used to select the study participants. The first participant will be selected by simple random sampling lottery method from the surgical cases performed under spinal anesthesia on the November 1st 2020. The rest of the participants was based on the interval calculated.

Interval = N⁄n = 399⁄215 = 1.85 = 2

N = estimated target population in the study period

n = final sample size

5.6 Study Variables

1. Independent variables
    - Age
    - BMI
    - Size of spinal needle
    - type of local anesthetic
    - Technique of spinal anesthesia
    - Number of attempts during puncture
    - Position of surgical procedure
    - Duration of surgery
    - Type of surgery
    - Time before start of mobility
    - Adjuvant
2. Dependent variables
    - Transient neurological symptoms

5.7 Operational definition

Transient neurological symptoms – is defined by a pain that ranges from mild to severe originating from the lower back and radiates to the buttocks and lower extremity that starts within 24 hours after spinal anesthesia and completely resolves after 4-10 days.

5.8 Method of Data Collection

Data was collected using questionnaires prepared in English and then translated to Amharic. The Amharic version of the questionnaire was assessed for compatibility with the English version by a group of people converting it back to English and comparing the converted versions. Data was collected by recovery nurses that have been trained about the manifestations of TNS and how to communicate with the patients. The data collector filled the questionnaires from the anesthesia sheet and by questioning the patient post

spinal anesthesia after 24 hours in the ward whether they experienced the symptoms of TNS or not in the first 24 hours. The data collected was checked for any conflicts that may occur during the data collection on the end of every week by the primary investigator. Contact information (phone number) of the patients with TNS on the first assessment was taken and they were informed about the follow up contact that will happen 10 days after the spinal anesthesia. The patients with TNS and are still admitted in the hospital had the follow up questioning in person by the data collector.

5.9 Data analysis

The data was entered to SPSS version 23 computer program for analysis. Descriptive statistics was to summarized and data, tables and figures were used for display results. The association among independent factors and the outcome variable was determined by binomial logistic regression and multiple logistic regression analysis and p-value of less than 0.05 were considered as statistically significant.

5.10 Plan for dissemination of result

The study will be available at the College of Health Sciences, Department of anesthesia. In addition, a copy of this material will be given to Dessie referral hospital, Addis Ababa University student research office and Ethiopian Association of Anesthetists.

5.11 Ethical considerations

Ethical clearance was obtained from the Departmental Research and Ethics Review Committee (DRERC) of Department of anesthesia, School of Medicine, college of Health Sciences of Addis Abba University and the acceptance was also obtained from the study institutions (Dessie referral hospital). Verbal Informed consent was taken from patients that were included in the study after the purposes of the study is fully explained to the patients. They were informed that they have free will to abandon the study at any time. The data was kept Confidential by using code numbers and keeping questionnaires locked secret in a way that only the researchers will get access to it.

6. Result

1. Demographic characteristics of study participants

The 215 Patients included in this study fulfilled the Criteria with 100% response rate. Among the study participants, the minimum age was 18 and maximum was 77 years with median age of 35 years. Relative to gender distribution ,133(61.9%) were females and 87(40.5) were male.

Table 1 Socio-demographic and physical characteristics of the study participants who underwent surgery under spinal anesthesia, in the period of February 1, 2021– April 30, 2021.

Variables		Frequency	Percentage
Sex	Female	133	61.9%
	Male	82	38.1%
Weight	42-62 kg	128	59.5%
	63-82 kg	87	40.5%
ASA	ASA I	189	87.9%
	ASA II	26	12.1%
Age	19-38	120	56.7%
	39-57	70	32.6%
	58-77	23	10.7%
BMI	Normal	153	71.2%
	Underweight	10	4.7%
	Overweight	43	20.%
	Obese	9	4.2%

2. Prevalence of post spinal anesthesia transient neurological symptoms

In this study we found the prevalence of post spinal anesthesia transient neurological symptoms to be 22(10.2%) out of 215 study participants.

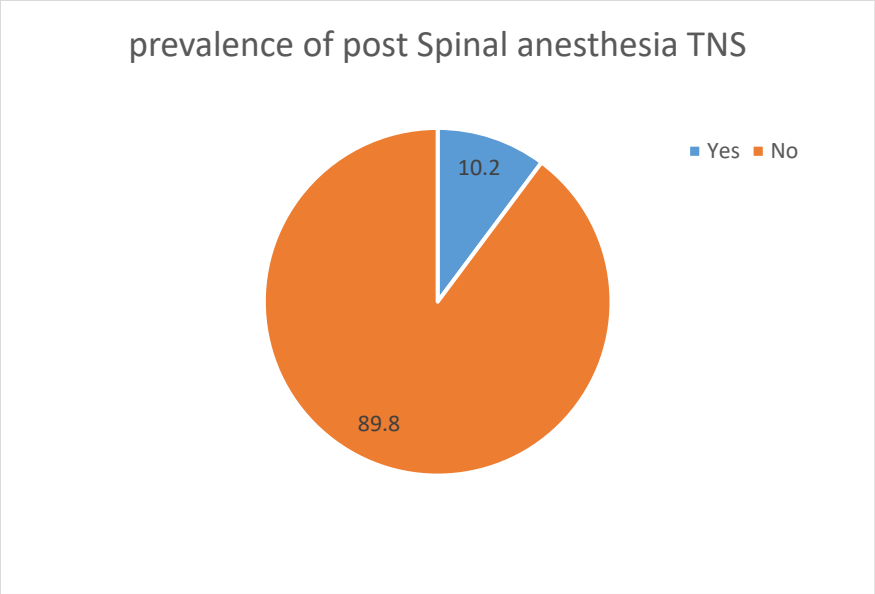


Figure 2 prevalence of post spinal anesthesia transient neurological symptom

Of the patients who developed post spinal Anesthesia transient neurological symptoms all of them had back of the thigh and bilateral pain. Follow up on patients who developed post SA TNS revealed that complete resolution of the symptom within 72 hours for 15(45.5%) of patients, 48 hours for 9 (40.9) of the patients and for the rest 3 (13.4%) it took 96 hours. most of the patients 18(82%) described the pain as numbness and hyperesthesia while the rest of the patients 4 (18%) stated as piercing type of pain.

All patients who developed post spinal anesthesia TNS showed no other post spinal anesthesia neurological complications like difficulty of urinating, defecating and muscle weakness. These symptoms are a new feeling and they had no history of this type of pain in their buttocks and lower extremities.

Table 2 location of pain among patients who developed Post SA TNS

Location of pain	No of cases	Percentage
Buttocks	21	95.5%
Front thighs	14	63.6%
Back thighs	22	100%
Legs	17	77%
Bilateral	22	100%

The intensity of pain felt by patients was measured by numerical rating scale in which pain ranging from 1-3 classified scaled as mild, 4-7 as moderate and 8-10 as severe.

Table 3 intensity of pain seen on patients who developed Post SA TNS

Pain intensity	No of cases	Percentage
Mild	17	71.2%
Moderate	5	22%
Severe	0	0%

3. Post SA transient neurological symptoms related factors

Thirty-nine patients had a history of spinal anesthesia exposure and none of them had a history of post SA TNS after the procedure. All patients that were given spinal anesthesia took bupivacaine with midline approach. 22 G needle was the most frequently used spinal needle which is 22.3% of total patients whereas 24 G is used the least 1.4%. The surgical procedures done were gynecology/obstetrics, orthopedics, urology.

Table 4 Spinal anesthesia and surgery related parameters of the study participants who underwent surgery under SA in the period of February 1, 2021– April 30, 2021

Variables		Presence of post SA TNS			
		Yes	%	No	%
Type of surgery	Ob/gyn	9	8.1%	102	91.9%
	Urology	7	10.8%	32	82.05%
	Orthopedics	6	9.2%	59	90.8%
Size of needle	18	4	36.4%	7	63.6%
	20	5	10.4%	43	89.6%
	21	1	10%	9	90%
	22	7	8.4%	76	91.6%
	23	5	8.3%	55	91.7%
	24	0	0%	3	100%
Attempts	1	12	10.8%	99	89.2%

	2	6	7.5%	74	92.5%
	3	4	16.7%	20	83.3%
Dose	2	0	0%	6	100%
	2.5	6	8%	69	92%
	3	10	15.9%	53	84.1%
	4	6	8.5%	65	91.5%
Position	Supine	14	8%	160	92%
	Lithotomy	8	27.6%	21	72.4%
	Prone	0	0%	0	0%
	Lateral	0	0%	12	100%

4. Factors associated with post spinal transient neurological symptoms

The Variables found to be significant with binary logistic regression were: weight, BMI, anesthesia time, spinal needle size and position of surgery. After analysis with multiple logistic regression BMI and position of surgery were found to be significantly associated with post SA TNS with p-value < 0.05.

Table 5 Factors associated with Post SA TNS of patients who underwent surgery under SA in the period of February 1, 2021– April 30, 2021, result of binomial logistic regression.

Variables		COR (95% CI)	P value
Weight		1.06 (1 – 1.114)	0.049
Spinal needle size		0.73 (.549 – 0.977)	0.034
BMI	Normal		0.063
	Underweight		0.999
	Overweight	3.56 (1.42 – 8.94)	0.007
	Obese		0.999
Position	Supine and lateral		
	Lithotomy	4.68 (1.76 – 12.47)	0.002
Anesthesia duration		0.98 (0.967 – 0.999)	0.042

Table 6: Factors associated with Post SA TNS of patients who underwent surgery under spinal anesthesia in the period of February 1, 2021– April 30, 2021. Results of multiple logistic regression.

Variables		Presence of post SA TNS		AOR (95% CI)	P value
		No	Yes		
BMI	Normal	141	12		
	Underweight	10	0		.999
	Overweight	33	10	2.94 (1.025-8.431)	.045
	Obese	9	0		.999
Position	Lithotomy	29	8	3.642 (1.197-11.082)	.023
	Supine and lateral	186	14		

7. Discussion

The prevalence of post spinal anesthesia transient neurological symptom among patients who underwent surgery under spinal anesthesia in Dessie referral hospital between February 1 2021 and April 30 2021 was assessed to be 10.2%. This result is lower than figures reported by other studies[9-11]. The possible reason for this could be because all of the study participants in our study received SA using bupivacaine and other studies included study participants who received SA with lidocaine which is believed to have high association with post SA TNS[10].

The main etiologies of TNS have not been explained the theories postulated before were needle trauma or ischemia as a result of sciatic nerve stretching[35]. There are different parameters that predispose patients for this proposed mechanism of TNS development like lithotomy surgical position, the type of needle used, early mobilization.

The cause was thought to be pooling of large amount of concentrated local anesthetics at the lumbosacral roots leading to excessive exposure and toxic effect[36].The concentration or the dose of the local anesthetics used showed no association with TNS development which debunked the idea of toxicity from local anesthetics[19]. The main factors highly correlated with the incidence of TNS were lithotomy surgical position and outpatient status or early mobilization after surgery. The effect of the local anesthetics could be increased by stretching of the lumbosacral nerve roots due to lithotomy surgical position and early mobilization.

Our research showed that BMI and surgical position were significantly associated with post SA TNS. Patients who were overweight had 2 times higher chance of developing TNS than those who had normal BMI (AOR = 2.9 and 95% CI: 1.03 - 8.43). These result was aligned with research conducted in San Francisco[11]. BMI is suspected to have an effect because patients with higher BMI have higher concentration of local anesthetics in there cerebrospinal fluid with respect to their lower level of cerebrospinal fluid volume.[11]

The other significantly associated factor is surgical position, lithotomy position was found to be highly associated with post SA TNS with 3 times higher risk of developing TNS than

other surgical position (AOR =3.64 and 95% CI: 1.19 – 11.08). These findings were also aligned with other studies conducted in Iran[10], San Francisco[11] Washington[26]. The lithotomy position is suspected to result in stretching of lumbosacral nerve roots increasing the vulnerability of nerve fibers exposed to local anesthetics [11] and decreasing vascular supply and increasing vulnerability to injury[26].

Of the patients who developed post spinal Anesthesia transient neurological symptoms all of them had back of the thigh and bilateral pain. Most of them had buttocks pain 21(95%) only one patient didn't have buttocks pain. More than half of the patients had front thigh pain14(63.6%). All but 5(22.7%) of the patients had leg pain. Complete resolution of the pain was seen in all patient with in the 4th day after the surgery.

The intensity of the pain in our study is reported to be scale of 1-3 mild (77.3) and 4-7 moderate (32.7%), other studies also stated the pain as mild and moderate[12, 29, 36]. The patients didn't require hospitalization rather they were treated with NSAID by their respective physicians.

Other factors associated with TNS like adjuvant phenylephrine[37], type of spinal needle[10], early mobility or outpatient status[11], and drug used were not able to be assessed since there were no comparative groups.

The limitation our study had were the fact that incidence of post SA TNS was assessed on the 24th hour after spinal anesthesia was given but there could be incidences that were identified up to 72 hours. The final assessment for resolution of pain was through phone call which could distort the quality of their response.

7.1 Conclusion

The incidence of post spinal anesthesia TNS was lower compared to other studies conducted. TNS development is affected by multiple factors combined rather than the type of drug used (lidocaine) which is believed to be the main factor. Other parameters could also aggravate and produce these symptoms. And in our study lithotomy surgical position and Higher BMI were found to have contributed for the incidence of TNS.

7.2 Recommendation

This study could be used as a base line for further studies to be conducted. There is a need for further study since there is not enough information with a better study design and large sample size used. There should be a better awareness about post-operative neurological complication among anesthetists and care givers.

What we could take from our study is that the presence of post spinal anesthesia transient neurological symptoms and the most susceptible patients like patients higher BMI and those procedures done under lithotomy position should be informed about this possible complication preoperatively.

8. Reference

1. Greene, N.M., *Spinal anesthesia: practical applications.* Yale J Biol Med, 1993. **66**(5): p. 433-6.
2. Wulf, Hinnerk F.W., *The Centennial of Spinal Anesthesia* Anesthesiology, 1998. **89**(2): p. 500-506.
3. Pu, X. and J.M. Sun, *General anesthesia vs spinal anesthesia for patients undergoing total-hip arthroplasty: A meta-analysis.* Medicine (Baltimore), 2019. **98**(16): p. e14925.
4. Schneider, M., et al., *Transient Neurologic Toxicity After Hyperbaric Subarachnoid Anesthesia with 5% Lidocaine.* 1993. **76**(5): p. 1154-1157.
5. Pollock, J.E., *Neurotoxicity of intrathecal local anaesthetics and transient neurological symptoms.* Best Pract Res Clin Anaesthesiol, 2003. **17**(3): p. 471-84.
6. Sankar, A., et al., *Transient Neurologic Symptoms following Spinal Anesthesia with Isobaric Mepivacaine: A Decade of Experience at Toronto Western Hospital.* Anesthesiology Research and Practice, 2018. **2018**: p. 1901426.
7. Pawlowski, J., et al., *Anesthetic and recovery profiles of lidocaine versus mepivacaine for spinal anesthesia in patients undergoing outpatient orthopedic arthroscopic procedures.* J Clin Anesth, 2012. **24**(2): p. 109-15.
8. Farid, I.S., et al., *Bupivacaine induces transient neurological symptoms after subarachnoid block.* Pain Pract, 2002. **2**(1): p. 53-5.
9. Hampl, K.F., et al., *Transient neurologic symptoms after spinal anesthesia.* Anesth Analg, 1995. **81**(6): p. 1148-53.
10. Etezadi, F., et al., *The effect of needle type, duration of surgery and position of the patient on the risk of transient neurologic symptoms.* Anesth Pain Med, 2013. **2**(4): p. 154-8.
11. Freedman, J.M., et al., *Transient neurologic symptoms after spinal anesthesia: an epidemiologic study of 1,863 patients.* Anesthesiology, 1998. **89**(3): p. 633-41.
12. Cramer, B.G., et al., *Transient neurological symptoms with subarachnoid lidocaine: effect of early mobilization.* Eur J Anaesthesiol, 2005. **22**(1): p. 35-9.
13. Forget, P., et al., *Transient neurological symptoms (TNS) following spinal anaesthesia with lidocaine versus other local anaesthetics in adult surgical patients: a network meta-analysis.* Cochrane Database Syst Rev, 2019. **12**: p. CD003006.
14. Evron, S., et al., *Transient neurological symptoms after isobaric subarachnoid anesthesia with 2% lidocaine: the impact of needle type.* Anesth Analg, 2007. **105**(5): p. 1494-9, table of contents.
15. Ready, L.B., et al., *Neurotoxicity of intrathecal local anesthetics in rabbits.* Anesthesiology, 1985. **63**(4): p. 364-70.
16. Panadero, A., et al., *Repeated transient neurological symptoms after spinal anaesthesia with hyperbaric 5% lidocaine.* Br J Anaesth, 1998. **81**(3): p. 471-2.
17. Pollock, Julia E., et al., *Dilution of Spinal Lidocaine Does Not Alter the Incidence of Transient Neurologic Symptoms* Anesthesiology, 1999. **90**(2): p. 445-450.
18. Hampl, K.F., et al., *Hyperosmolarity does not contribute to transient radicular irritation after spinal anesthesia with hyperbaric 5% lidocaine.* Reg Anesth, 1995. **20**(5): p. 363-8.
19. Tong, D., et al., *Prospective study on incidence and functional impact of transient neurologic symptoms associated with 1% versus 5% hyperbaric lidocaine in short urologic procedures.* Anesthesiology, 2003. **98**(2): p. 485-94.
20. GOZDEMIR, M., et al., *Transient neurological symptoms after spinal anaesthesia with levobupivacaine 5 mg/ml or lidocaine 20 mg/ml.* 2010. **54**(1): p. 59-64.
21. Pollock, J.E., et al., *Dilution of spinal lidocaine does not alter the incidence of transient neurologic symptoms.* Anesthesiology, 1999. **90**(2): p. 445-50.

22. Drasner, K., *Lidocaine spinal anesthesia: a vanishing therapeutic index?* Anesthesiology, 1997. **87**(3): p. 469-72.
23. de Jong, R.H., *Last round for a "heavyweight"?* Anesthesia and analgesia, 1994. **78**(1): p. 3-4.
24. Van Elstraete, A.C. and T. Lebrun, *Transient radicular irritation after spinal anaesthesia.* Acta anaesthesiologica Scandinavica, 1996. **40**(7): p. 864-865.
25. Tarkkila, P., J. Huhtala, and M. Tuominen, *Transient radicular irritation after spinal anaesthesia with hyperbaric 5% lignocaine.* Br J Anaesth, 1995. **74**(3): p. 328-9.
26. Pollock, J.E., et al., *Prospective study of the incidence of transient radicular irritation in patients undergoing spinal anesthesia.* Anesthesiology, 1996. **84**(6): p. 1361-7.
27. de Weert, K., et al., *The incidence of transient neurological symptoms after spinal anaesthesia with lidocaine compared to prilocaine.* Anaesthesia, 2000. **55**(10): p. 1020-4.
28. Martínez-Bourio, R., et al., *Incidence of transient neurologic symptoms after hyperbaric subarachnoid anesthesia with 5% lidocaine and 5% prilocaine.* Anesthesiology, 1998. **88**(3): p. 624-8.
29. Philip, J., et al., *Transient neurologic symptoms after spinal anesthesia with lidocaine in obstetric patients.* Anesth Analg, 2001. **92**(2): p. 405-9.
30. Ates Cetin, Z., N. Kayacan, and B. Karsli, *[Transient neurological symptoms after spinal anesthesia].* Agri, 2018. **30**(2): p. 58-70.
31. Cöcelli, L.P., et al., *Transient neurologic syndrome after spinal anesthesia with epidural steroid treatment.* Curr Ther Res Clin Exp, 2009. **70**(4): p. 316-22.
32. Tilahun, A., et al., *Magnitude and associated factors of nausea and vomiting after ce- sarean section under spinal anesthesia in Gandhi memorial Hospi- tal, Addis Ababa, Ethiopia. A cross-sectional study.* 2020.
33. Kassa, A., *Post Dural Puncture Headache (PDPH) and Associated Factors after Spinal Anesthesia among Patients in University of Gondar Referral and Teaching Hospital, Gondar, North West Ethiopia.* Journal of Anesthesia & Clinical Research, 2015. **06**.
34. Zeleke, T.G., et al., *Prevalence and Factors Associated with Back Pain among Patients Undergoing Spinal Anesthesia at the University of Gondar Comprehensive and Specialized Hospital, North West Ethiopia: An Institutional Based Cross-Sectional Study.* Advances in Medicine, 2021. **2021**: p. 6654321.
35. Salmela, L., U. Aromaa, and D.A. Cozanitis, *Leg and back pain after spinal anaesthesia involving hyperbaric 5% lignocaine.* Anaesthesia, 1996. **51**(4): p. 391-3.
36. Hiller, A. and P.H. Rosenberg, *Transient neurological symptoms after spinal anaesthesia with 4% mepivacaine and 0.5% bupivacaine.* Br J Anaesth, 1997. **79**(3): p. 301-5.
37. Sakura, S., et al., *The addition of phenylephrine contributes to the development of transient neurologic symptoms after spinal anesthesia with 0.5% tetracaine.* Anesthesiology, 1997. **87**(4): p. 771-8.

9. Annex

Annex: I Assurance of principal investigator

Addis Ababa University, College of Health Science, Department of Anesthesia

Questionnaire

I the undersigned agree to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this Application.

Name of the principal investigator: _____

Date. February, 2021 Signature _____

Name of the advisor: _____

Date. February, 2021 Signature _____

Information sheet

Hello.

My name is _____. I am a member of researchers and I have been attending postgraduate program in the field of Anesthesia at Addis Ababa University. I am going to conduct research on the prevalence and associated factors of post spinal anesthesia Transient neurological symptoms at Dessie referral hospital, south Wollo, Ethiopia, from February 1st, 2021 – April 30th, 2021 the information going to be obtained will help the government and health provides to provide a better anesthesia services in the future. Your participation is very valuable for the success of this project. Also be mindful that whatever we will get here is for research purposes only and the information will not be used by any other person apart from this research and therefore, confidentiality can be guaranteed. However, your names will not be mentioned or be attached to anything that you say.

Do you want to continue yes---------- No---------- (Thank you in advance for your help!)

Name and contact address of investigators

Sara Timerga

Sara24tn@gmail.com

Cell phone +251-95044807

Annex II

Part I Sociodemographic information from chart

Card number _____ Phone number _____

1. Age _____
2. Sex
   1. Male ☐ 2. Female ☐
3. Weight _____
4. Height _____
5. BMI
   1. Underweight ☐ 3. Normal ☐
   2. Overweight ☐ 4. Obese ☐
6. ASA Classification
   1. ASA I ☐ 2. ASA II ☐
7. History of previous anesthesia exposure
   1. Yes ☐ 2. No ☐
8. If the answer on number 4 is yes, the type of anesthesia given
   1. General anesthesia ☐ 2. Spinal anesthesia ☐
9. If spinal the anesthetic drug used
   1. Lidocaine ☐ 2. Bupivacaine ☐
10. If previous history of anesthesia is SA was there a TNS post operatively
    1. Yes ☐ 2. No ☐

Part II Intraoperative information from anesthesia sheet

1. Diagnosis _____
2. Type of surgical procedure performed
   _____
3. Admission status
   1. Outpatient ☐
   2. Inpatient ☐
4. Spinal needle used

   Type _____

   Size of needle _____
5. Spinal anesthesia approach used
   1. Midline ☐ 2. Para medial ☐
6. Number of attempts for spinal anesthesia _____
7. Local anesthetics used for spinal anesthesia
   1. Bupivacaine ☐ 2. lidocaine ☐
8. Dose of the drug used for spinal anesthesia _____
9. Adjuvants added for spinal anesthesia
   1. Yes ☐ 2. No ☐
10. If adjuvants used what kind
    _____
11. Patient Position for surgical procedure
    1. Supine ☐ 3. Prone ☐
    2. Lithotomy ☐ 4. Lateral ☐

12. Duration of surgical procedure _____

13. Duration of anesthesia _____

14. Additional postoperative analgesic given

1. Opioids ☐ 2. Peripheral nerve block ☐
3. NSAID ☐ 4. Other ☐
5. None ☐

15. If peripheral nerve block done what kind _____

Part III Postoperative information from patients after 24 hours of taking Spinal Anesthesia

1. ማደንዘዣ የተወጉበት ቦታ የሚሰማዎት የህመም ስሜት አለ?

1. አዎ ☐ 2. የለም ☐

2. ማደንዘዣ ሙሉ ለሙሉ ለቅዎታል?

1. አዎ ☐ 2. አለቀቀኝም ☐

3. ካለቀቅዎት ምን ምን ችግር አለ?

1. ድካም ☐
2. ማዞር ☐
3. ማቅለሽለሽ ና ማስመለስ ☐
4. ለመሸናት ና ለመጸዳዳት መቸገር ☐

4. ኦፕሬሽን የተሰሩበት ቦታ የሚሰማዎት የህመም ስሜት አለ?

1. አዎ ☐ 2. የለም ☐

5. አዲስ የተለየ ስሜት የሚሰማዎት አለ?

1. አዎ ☐ 2. የለም ☐

6. ካለ የትኛው የሰውነት ክፍል ላይ?

አዲስ የተለየ ስሜት ካለ ወደ ሚቀጥልው ጥያቄ ቀጥሉ

1. የሚሰማዎት አዲስ የተለየ ስሜት አለ?

   1. አዎ ☐ 2. የለም ☐

2. ከላይ የተጠቀሰው መልስ አለ ከሆነ ኦፕሬሽን ከተሰራበት ቦታ ውጭ የሚሰማዎት የተለየ ስሜት አለ?

   1. አዎ ☐ 2. የለም ☐

3. ከላይ የተጠቀሰው መልስ አዎ ከሆነ ስሜቱን ይግለጹ

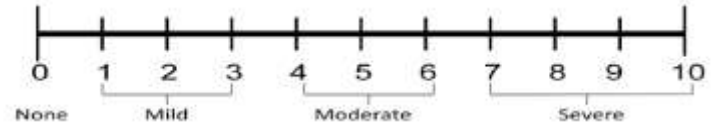
   1. ማቃጠል ☐ 5. ማቃጠል ☐
   2. ውጋት ☐ 6. ሲነኩ በቀላሉ መሰማት ☐
   3. መደንዘዝ ☐ 7. ሌሎች ☐
   4. መጠዝጠዝ ☐

4. የዚ ስሜት የሚግኝበት ቦታ

   1. መቀመጫ ላይ ☐ በአንድ በኩል ☐ በሁለቱም በኩል ☐
   2. የታፋ ፊት ☐ በአንድ በኩል ☐ በሁለቱም በኩል ☐
   3. የታፋ ጀርባ ☐ በአንድ በኩል ☐ በሁለቱም በኩል ☐
   4. እግር ☐ በአንድ በኩል ☐ በሁለቱም በኩል ☐
   5. ማደንዘዣ የተወጉበት ቦታ ☐

5. የህመሙ ክብደት መጠን መለኪያ

Numerical rating scale to measure severity of pain



አሁን ያለዎት ህመም ከአንድ - አስር ስንት ይሆናል?

6. ከዚ በፊት እንደዚ አይንት የህመም ስሜት ተሰምትዎት ያቃል?

   1. አዎ ☐ 2. አያውቅም ☐

7. ለመሽናት ያስቸግሮታል?

   1. አዎ ☐ 2. አያስቸግረኝም ☐

8. ለመጸዳዳት ያስቸግሮታል?

   1. አዎ ☐ 2. አያስቸግረኝም ☐

9. የጡንቻ መድከም / መዛል አለዎት?

   1. አዎ ☐ 2. የለም ☐

ከ10 ቀናት ቡሀላ የሚጠየቅ ጥያቄ

1. ከ10 ቀናት በፊት የነበረ የህመም ስሜት እስካሁን አለ?

   1. አዎ ☐ 2. የለም ☐

2. ከሌለ መቼ አቆመ?

   _____