**PRE-OPERATIVE ANXIETY**

Surgery is a huge source of various physical and mental stimuli for patients. Surgery may lead to anxiety, fear, pessimism, and other negative emotions in patients who may not have recovered from the emotional shock of the disease itself, and the ensuing anxiety is widely accepted as a normal response in preoperative patients [[[1]](#endnote-1),[[2]](#endnote-2)].

Preoperative anxiety, even at high levels, does not generally meet the clinical diagnosis of general anxiety disorders. Importantly, preoperative anxiety is potentially modifiable, and identifying these patients may provide an opportunity to increase psychological comfort, thereby improving postoperative outcomes [[[3]](#endnote-3)].

Given the high rates of previously undiagnosed psychological conditions, preoperative psychological assessment is now a prerequisite for providing timely and appropriate interventions in some medical settings [[[4]](#endnote-4)]. The administration of a simple screening questionnaire may warrant further studies for rapid bedside evaluations. A quick evaluation of anxiety symptoms as part of the preoperative visit may allow the identification of high-risk patients, and subsequently, appropriate pharmacological or psychotherapeutic interventions may be applied [[[5]](#endnote-5),[[6]](#endnote-6)].

1. Definition of pre-operative anxiety:

Pre-operative anxiety is described as a vague, uneasy feeling, the source of which is often nonspecific and unknown to the individual [[[7]](#endnote-7)] but known to cause abnormal hemodynamic because of sympathetic, parasympathetic, and endocrine stimulation. But this pre-operative anxiety can occur in any person in a transient or chronic form and can produce aggressive reactions that result in increased stress experienced by the patient, thus causing more difficult pain management in the postoperative period [[[8]](#endnote-8)]. Hence, Perioperative period is a stressful event that triggers specific emotional, cognitive, and physiological responses of a patient that can be defined as a pre-operative anxiety.

Awaiting surgery is known to provoke anxiety. Preoperative anxiety may be the reason of postponement of the surgical procedure or negatively influence the surgical process. Anxiety can be explained as a reaction to stress or fear and elicits the autonomic physiological response that helps a person to fight or flight the danger (Marran 2010, p. 9).

The American Psychological Association defines anxiety as "an emotion characterized by feelings of tension, worried thoughts and physical changes like increased blood pressure." Anxiety is a subjective feeling of nervousness, worry and tension.

2.Theorical literature of pre-operative anxiety:

Studies have shown that people react differently to anxiety-provoking situations and related this difference to trait anxiety that described by Spielberger as an established individual difference in anxiety proneness and how stressful situations are perceived, Here State anxiety reflects the psychological and physiological transient reactions directly related to adverse situations in a specific moment. In contrast, the term trait anxiety refers to a trait of personality, describing individual differences related to a tendency to present state anxiety. (Marran, 2010, p. 12).

Bakr, Ali, and Khudhr (2014, p. 2) have described trait anxiety as a relatively permanent personality characteristic that is not influenced by a stressful situation. This implies that surgery does not affect trait anxiety of the patient.

However, state anxiety that has been described as an unpleasant emotional response while coping with threatening or dangerous situations (Tovilović *et al.* 2009, p. 492). State anxiety level varies depending on how the situation is judged by an individual to be high or low threatening. State anxiety level is high in a dangerous situation and low in the safe or less dangerous situation (Bakr, Ali, & Khudhr 2014, p. 2).

According to Strongman K.T. (1995, p. 8), the anxiety is different from fear in sense that fear is caused by tangible object with known expected outcome and it can be escaped while anxiety happens when the danger is not palpable and it cannot be avoided, the author continued showing that anxiety is characterized by being unsure of the future and how to behave once a person meets the danger.

It has been reported that the main purpose or function of anxiety is to detect the danger or threat in a potentially harmful environment so that a person reacts effectively to escape the danger (Douilliez and Philippot 2006, p. 8).

3. Incidence & prevalence of pre-operative anxiety:

According to World Health Organization (2010), Finland has approximately 11,592 in-patient surgical procedure per 100,000 populations. The incidence of preoperative anxiety is reported to range from 60 percent to 80 percent in Western Europe population, but some studies show wider range from 11 percent to 80 percent among adult patients (Bedaso & Ayalew 2019, 18). Among 239 patient’s 70 percent experienced some degree of anxiety before the operation (Nigussie, Belachew & Wolancho 2014, 67). During pre-operative period patient's sensation of stress increased which contributed to induce “negative trance”, an altered state of consciousness (Komolafe, Csernus & Fülöp 2015, 80).

The incidence of preoperative anxiety varies according to the setting of surgery, gender, and motives for surgery. The prevalence is higher ranging from 32% in a study done on patients awaiting general surgery[[[9]](#endnote-9)] to 50% in patients awaiting coronary artery bypass graft surgery (CABG) [[[10]](#endnote-10)] and the prevalence is similar or even higher in Asian population [[[11]](#endnote-11)].

In accordance with anxiety found in the different patient populations described above, the incidence and degree of preoperative anxiety also varies [[[12]](#endnote-12)]. Preoperative anxiety begins from treatment planning and gradually increases until it reaches its peak when entering the operating room [[[13]](#endnote-13)]. A systematic review and meta-analysis of studies worldwide reported a pooled prevalence of 48% for preoperative anxiety among patients undergoing surgery [[[14]](#endnote-14)].

However, the prevalence of preoperative anxiety varies according to the type of surgery, patients’ sex and age, and country [[[15]](#endnote-15)]. The type of surgery is an important factor affecting the prevalence of preoperative anxiety. Studies conducted in Europe have shown that the prevalence of preoperative anxiety among patients undergoing surgery varies from 27% to 80%. Hellstadius et al. reported that 34% of oesophageal cancer patients experienced pre-surgical anxiety; 15% of them had mild anxiety, 14% had moderate anxiety, and 5% had severe anxiety [[[16]](#endnote-16)].

Preoperative anxiety in patients undergoing cardiac surgery is much more common, as the risks associated with such complex operations make patients feel insecure. This is evidenced by the findings of Prado-Olivares et al., who showed that anxiety was identified in 80% of patients, and 40% of patients had high anxiety before surgery [[[17]](#endnote-17)].

The prevalence of preoperative anxiety varies by country and region. Among patients undergoing total knee arthroplasty, the incidence of preoperative anxiety was 20.2% in the United States [[[18]](#endnote-18)] and 22.7% in the Netherlands [[[19]](#endnote-19)]. In line with previous findings that preoperative psychological problems appear to be more serious in Asians [[[20]](#endnote-20)], the incidence of preoperative anxiety prior to total knee arthroplasty was 45.24% in Chinese patients [[[21]](#endnote-21)]. These differences may be due to a variety of factors, such as socioeconomic characteristics and culture, which are also key environmental factors that contribute to the different expression of personality traits.

4. Empirical literature on levels of preoperative anxiety

Some extent of anxiety is normal defence mechanism that motivates people to get the necessary action. For example, lower level of anxiety during exam period will motive an individual to read. On the other hand, excessive amounts of anxiety can cause negative effects on an individual. (Osborn & Sandler 2004, 46-47.)

**Heldegard E. Peplau, an American psychiatric, nursing theorist and a nurse**, had presented **four** level of anxiety according to the severity of the patient's presenting symptoms.

A.The initial level, mild anxiety has normal physiological reaction to stressors that have positive affect on individual, which can show symptoms like; irritability, impatience, complaints of slight discomfort behaviours such as nail biting, finger or foot tapping, or fidgeting are typical symptoms of mild anxiety. (Frazier, Moser, Riegel, McKinley, Blakely & Garvin 2002, 57; Disano 2015, 6.)

B. The next level of anxiety is Moderate anxiety which is manifested in an individual through feelings of tension, worry and nervousness. This increased level of anxiety decreases the ability to solve problem and comprehend information. The individual's capacity to understand a situation or a specific concept is more limited than in mild anxiety. In moderate anxiety, the patient may show physical symptoms like; muscle tension, diaphoresis, headache, pounding pulse, dry mouth, voice change, frequent urination, increases automatisms. (Videbeck 2014, 50.)

C. The third level, severe anxiety where an individual has feeling of horror or awe. An individual shows difficulty in thinking and reasoning. The person is unable to learn new skills, solve problems and incapable to figure out what is going and present physical symptoms like; worse headache, nausea, vomiting, diarrhoea, withdrawal, threats and demands, dizziness, confusion, insomnia, trembling, tachycardia, hyperventilation, and chest pain. (Disano 2015, 6; Videbeck 2014, 50.)

D. The last and most intense level of anxiety is known as panic characterized through frightening emotions which can cause an individual to lose control where individual may begin to pace, run, shout, scream or withdraw and shows physical symptoms like; severe hyperactivity or immobility, dilated pupils, severe shakiness, experiences of terror, sleeplessness, severe withdrawal, hallucinations, or delusions. (Disano 2015, 6; Videbeck 2014, 50.)

Some author had categorized preoperative anxiety in either **high or low levels**, **clinically significant or not clinically significant**. However, clinically significant preoperative anxiety and high preoperative anxiety level are used interchangeably, and not clinically significant and low preoperative anxiety levels are used interchangeably. Some authors classify the levels of preoperative anxiety in no, mild, moderate, or severe preoperative anxiety (Bakr, Ali and Khudhr 2014, p.3). The categorization of levels of preoperative anxiety depends on the used preoperative anxiety assessment tool based on its cut-off score.

Grading of various scale for level of anxiety:

a. The studies using Hospital Anxiety and Depression Scale (HADS) consider the sum score ≥11 as high preoperative anxiety level and the sum score <11 as low preoperative anxiety level (Santos, Martins and Oliveira 2014, p.7; Williams *et al.* 2014, p.1).

b. For studies that employ State version of State Trait Anxiety Inventory (S-STAI) to assess preoperative anxiety consider the sum score > 44 score as significant anxiety or high anxiety level and the sum score ≤44 as low anxiety level or not significant anxiety (Jafar and Khan 2009,p 359; Nigussie, Belachew and Wolancho 2014, p.5)

c. For the studies using the Pre-operative Intrusive Thoughts Inventory (‘The PITI’ or ‘PITI-20’) consider the sum score ≥15 as clinically significant preoperative anxiety level and the sum score <15 as not clinically significant preoperative anxiety level (Crockett, Gumley and Longmate 2007, p. 688).

5.Triggering Factors of pre-operative Anxiety:

Some of the factors which can trigger the level of preoperative fears, that all depend on age, gender, single or divorce, education, uncertainty of the exact day of surgery, patient’s ability to understand the events that occur during surgical anaesthesia, fear of surgery, separation from their family, financial loss, postoperative pain, fear of death and fear of unknown origin [[[22]](#endnote-22),[[23]](#endnote-23),[[24]](#endnote-24)].

Also, lack of adequate and timely information to patients during the pre-anaesthetic consultation increases patient anxiety. Clinical Study found that patients receiving better pre-anaesthetic information during the visit with the anaesthesiologist showed reduced rates of anxiety compared to those who did not receive it [[[25]](#endnote-25)]. The day of admission can also be very stressful, as patients must cope with both the stress of hospitalization and the anxiety about the impending surgery.

6. Factors associated with preoperative anxiety.

It has been reported that preoperative anxiety may be associated with many factors. These include demographic data, previous surgical experience, and anaesthetic technique, types of surgical procedures, medical diagnosis, and information about surgery.

A. Age:

* Jafar and Khan (2009, p.360) conducted study in Pakistani, they found that age is contributing factor predicting preoperative anxiety and preoperative anxiety decreased with an increase in age (p< 0.001) , similarly Bakr, Ali, and Khudhr (2014, p. 6) found that young patients are more anxious than old age patients (P<0.01) and they reported that, this happened because young people are less experienced and more prone to anxiety and fear compared to old age people.
* Contrary to those studies, Fathi *et al.* (2014, p. 92) found that the anxiety levels increased with the age, the old patients presented the higher level of anxiety than young patients (p < 0.001) , this finding was in line with the results of study conducted by (Basak *et al.* 2015, p. 19) that showed that patients who were aged more than 35 years old expressed more anxiety than young patients and Nigussie et al. (2014, p. 5) found that age does not influence the preoperative anxiety levels significantly. Kim *et al.* (2010, p.330) showed that for the patients aged 45 or older had high preoperative anxiety levels and their anxiety scores correlated significantly with the changes in pulses rate (P = 0.047 by Pearson correlation), in addition preoperative anxiety scores predicted a 20 % or more change in blood pressure ((AUC = 0.729, P = 0.024) and in heart rate (AUC=0.767, P=0.049).

Age is believed to be negatively correlated with preoperative anxiety; patients aged below 50 years had a significantly higher incidence and degree of preoperative anxiety than those aged more than 50 [[[26]](#endnote-26),[[27]](#endnote-27)]. However, some studies have shown that older patients experience higher levels of preoperative anxiety than younger patients because of comorbidities [[[28]](#endnote-28)]. Research has also shown that age is not a risk factor for preoperative anxiety [[[29]](#endnote-29)].

B.Gender:

* The study conducted by Maheshwari and Ismail (2015, p.196) showed that women with high preoperative anxiety levels preferred general anaesthesia for caesarean section (*P* < 0.005).
* The study conducted in Sri Lanka by Matthias and Samarasekera (2011, p. 4) showed that females experienced more preoperative anxiety for surgery and anaesthesia than males, similar results were found in a study conducted by Fathi *et al.* (2014, p. 92) in Iran that women experienced more anxiety than men. Masood *et al.* (2009, p. 39) and Basak *et al.* (2015, p. 19) explained these findings to be due to family relationship closeness and bonding of the females and the fact that women easily express the anxiety, and they are more affected by separation from their family.
* Contrary to this study Nigussie, Belachew and Wolancho (2014, p. 5) in their study conducted in Jimma University Specialized and Teaching Hospital in Ethiopia showed that sex did not influence significantly preoperative anxiety.

So, Gender was found to be an influential factor and a predictor that had a positive significant correlation with preoperative anxiety, with female sex being associated with higher levels of anxiety [[[30]](#endnote-30),[[31]](#endnote-31),[[32]](#endnote-32),[[33]](#endnote-33)]. Among female patients, preoperative anxiety before elective caesarean section was more extensive and severe, with an incidence of approximately 72.7% [[[34]](#endnote-34)]. The reasons for this could be physical discomfort and concerns about the safety of the foetus.

C. Marital Status/Economical status/Eduation:

* Marital status has been identified by some of the researchers as the factor affecting preoperative anxiety. Fathi *et al.* (2014, p. 94) found that widowed or divorced female experienced more anxiety while single and married patients experienced lower preoperative anxiety levels. This study also showed that high education levels and income rate and better social support were significantly correlated with lower preoperative anxiety, these study findings are like that reported by (Basak *et al.* 2015, p. 19) who reported that low income and low level of education were associated with higher anxiety.
* Contrary to these findings Nigussie, Belachew, and Wolancho (2014, p. 5) found that education level did not influence preoperative anxiety and higher income rate correlated with higher anxiety levels and Komolafe and Csernus (2015, p. 97) found that feeling anxious was not associated with marital status (*p* ≤ 0.375).

D. History of previous surgery:

* Previous surgery affects the anxiety of the patients as demonstrated by many studies (Bakr, Ali, and Khudhr 2014, p. 5; Jafar and Khan 2009, p. 361 and Homzová and Zeleníková 2015, p. 324) that reported that patients who had at least one prior surgery presented a low level of anxiety. This may be explained by having a history of surgery makes the patient more aware of the surgical process (anaesthesia, intraoperative and postoperative pain control, and probable outcomes of surgery) that prevent patient to develop more fear of unknown or rely on a misconception about anaesthesia and surgery. In addition, those patients were survived from previous surgery and did not develop any or severe complication from surgery and got signs and symptoms relieved after surgery.
* Contrary to those findings, Nigussie, Belachew, and Wolancho (2014, p. 5) and Hong (2001, p. 4) found that having previous surgical operation or anaesthesia did not influence significantly preoperative anxiety, this was explained as due to lack of understanding on explanation or lack of information on that previous experience of surgery or anaesthesia and they concluded that nature and quality of previous surgery is more important factor influencing the anxiety than just having previous surgery.
* Shoaei *et al.* (2016, p. 707) found that the longer the patient’s waiting time for surgery, the higher anxiety (P=0.003). In addition, Matthias and Samarasekera (2011, p. 5) found that waiting for the operation was ranked the first anxiety causing factor for preoperative anxiety.
* Provision of information was reported to be associated with low preoperative anxiety. This is supported Lee *et al.* (2016, p. 698) who found that surgeon’s explanation of the surgery performed reduce preoperative anxiety 72.3 %, Aust *et al.* (2016, p. 4) reported that 63.7% of the patients believed that information would aid them to cope with their anxiety.

E. Types of anaesthesia:

The type of anaesthesia may also influence the occurrence of preoperative anxiety. Patients who were subjected to spinal anaesthesia had a significantly lower incidence and severity of preoperative anxiety than those under general anaesthesia [[[35]](#endnote-35),[[36]](#endnote-36)].

* Some studies reported that types of anaesthetic technique are associated factors with preoperative anxiety. This was supported by study conducted by Bosc *et al.* (2015) in patients undergoing oculoplastic and strabismus surgery found that patients undergone surgery under general anaesthesia had higher anxiety levels than patients undergone surgery under local anaesthesia (P=0.002). In addition, some other studies reported that patients under general anaesthesia are more anxious than patients under local anaesthesia (Jawaid *et al.* 2007, p. 147; Mitchell 2013, p. 41; Maheshwari and Ismail 2015, p. 197).
* Maheshwari et al. reported that the prevalence of preoperative anxiety was significantly higher in patients who received general anaesthesia (97.18%) compared with those who received regional anaesthesia (51.81%) for elective caesarean section [[[37]](#endnote-37)]. In addition, emergency surgery, education level, family support, and previous surgical experience may also affect preoperative anxiety [[[38]](#endnote-38),[[39]](#endnote-39),[[40]](#endnote-40),[[41]](#endnote-41)]. However, the influence of these factors on preoperative anxiety is complex, and further research is needed to identify and clarify these associations. Currently, the widely accepted view is that patients with higher preoperative anxiety are younger, female, undergoing major or emergency surgery under general anaesthesia, and have family support.

7. Psycho-somatic response to pre-operative anxiety

Most patients are anxious during the preoperative period as a natural reaction to unpredictable and potentially threatening situations [[[42]](#endnote-42),[[43]](#endnote-43)]. But, the extent of anxiety levels varies individually. It fluctuates over time; starting prior to the surgery and persists until the late postoperative period. Different patient reacts to perioperative periods in different ways. Some find it as relief as they are going to have a disease-free life. Other considered it as one of the stressful events of lifetime.

They are preoccupied with their discomfort or concerned about the success of surgery, strong fear of failure combined with career and family problems, postoperative state of physical health and problems adapting to the changed situation.

Excessive degrees of preoperative anxiety induced by real or even implied threats can activate the stress axis, namely, the hypothalamic-pituitary-adrenocortical (HPA) system, which in turn induces multisystem physiological responses, primarily in the cardiovascular system [[[44]](#endnote-44),[[45]](#endnote-45)]. These responses include tachycardia, hypertension, arrhythmias, and higher levels of pain, which may persist in the postoperative period [[[46]](#endnote-46)]. The impact can be multidimensional and dramatic, with serious physical and mental consequences [[[47]](#endnote-47)].

**Operative impact:**

Preoperative anxiety can contribute to resistance to anaesthetics; thereby increasing the dosage of anaesthetic needed intraoperatively, which makes patients more vulnerable to unfavourable events, including delayed recovery from anaesthesia [[[48]](#endnote-48),[[49]](#endnote-49)]. It has been shown that patients with higher anxiety scores (both state and trait anxiety) required greater amounts of propofol to attain light and moderate levels of sedation [[[50]](#endnote-50)].

Kil *et al.* (2012, pp. 121-122) found that patients with higher preoperative anxiety required a greater amount of propofol to reach light sedation (r2 =0.053 *P*=0.021) and moderate sedation (*r*2=0.127 *P*=0.010). In addition, Study founded that the patients with high anxiety had more agitation (p=0.029) and shivering (P=0.044) as side effects of anaesthetic agents than patients with low anxiety (Ali, Altun and Hakan 2014, p. 225).

So, assessing preoperative anxiety levels could theoretically help guide perioperative anaesthetic and analgesic doses.

Furthermore, Increased morbidity in anxious patients are associated with the development of cardiovascular lesions because of health-related behaviours (such as smoking, poor diet, poor compliance with treatment, or an inactive lifestyle) and direct influence on the myocardial perfusion, autonomic nervous system regulation, platelet activation, increased hypothalamo-pituitary-adrenal axis activity and exaggerated inflammatory processes [[[51]](#endnote-51),[[52]](#endnote-52),[[53]](#endnote-53)].

**Post-operative impact:**

It has been shown that a curved, rather than a simple linear relationship, exists between preoperative anxiety and postoperative complications; for instance, the incidence of postoperative complications was significantly lower in patients with mild anxiety than in those without anxiety or with moderate-to-severe anxiety. Although such a conclusion is still controversial, it is possible that mild anxiety promotes adaptive actions to cope with jeopardizing stimuli, thereby improving postoperative outcomes [[[54]](#endnote-54),[[55]](#endnote-55)]. However, it has been proved that excessive anxiety negatively affects patients’ outcomes, as demonstrated among patients in a variety of medical settings [[[56]](#endnote-56),[[57]](#endnote-57),[[58]](#endnote-58),[[59]](#endnote-59),[[60]](#endnote-60),[[61]](#endnote-61)].

The adverse effects of preoperative anxiety on perioperative outcomes of patients are roughly divided into **four** aspects related to patients’ feelings, medical intervention, complications, and postoperative recovery.

The level of preoperative anxiety is closely related to postoperative pain, discomfort, satisfaction with recovery from surgery, and psychosocial outcomes; high levels of anxiety are associated with higher levels of discomfort and dissatisfaction [[[62]](#endnote-62),[[63]](#endnote-63)].

**Post- operative pain:** Pain is a very common, complex, subjective, and emotional sensory experience with both physiochemical and affective components. Pain can be a source of anxiety that increases its incidence and severity. Preoperative anxiety has long been recognized as a significant predictor of postoperative pain [[[64]](#endnote-64),[[65]](#endnote-65)]. Studies have reported that preoperative state anxiety was positively correlated with postoperative pain [[[66]](#endnote-66),[[67]](#endnote-67),[[68]](#endnote-68)]. the underlying mechanisms may be that anxiety is associated with a lower pain threshold [[[69]](#endnote-69)], overestimation of pain intensity [[[70]](#endnote-70)], and activation of the entorhinal cortex of the hippocampal formation [[[71]](#endnote-71)].

Study by Ali, Altun and Hakan (2014, p. 225) who found that preoperative anxiety scores significantly correlate with the duration of hospitalization (r = 0.370, p = 0.001), and patients with a high anxiety had longer extubating time than patients with low anxiety (P=0.03).

**Patients’ satisfaction:** In a study conducted on patients undergone total knee arthroplasty found that patients with high preoperative anxiety or depression had more than 6 times high risk to be dissatisfied than patients without anxiety or depression and patients with post-operative deep infection had 3 times risk to be dissatisfied, those dissatisfied patients had 1 day more of hospital stay than satisfied patients (Ali *et al.* 2016, p. 3).

**Risk of infection/Nausea/Vomiting:** Preoperative anxiety is associated with the risk of infection and with postoperative nausea and vomiting (Pokharel 2011, p. 373; Homzová and Zeleníková 2015, p. 324; Ayla *et al.* 2016, p. 1). Van Den Bosch et al. also showed an increased incidence of postoperative nausea and vomiting depending on the level of preoperative anxiety [[[72]](#endnote-72)]. Furthermore, excessive anxiety triggers a physiological stress response that can impede wound healing [[[73]](#endnote-73)]. Studies have shown that preoperative anxiety also plays a role in increasing the risk of infection and weakening the immune response [[[74]](#endnote-74)]. In patients with severe preoperative anxiety, the ability to return to daily activities and pre-surgery quality of life may be affected [[[75]](#endnote-75)].

**Cardiac events/Mortality:** Perioperative cardiac events may lead to irreversible consequences, and untreated anxiety is associated with major cardiac events in cardiac patients [[[76]](#endnote-76)], such as congestive heart failure, acute myocardial infarction, and pulmonary edema. A study from Korea found that the State-Trait Anxiety Inventory (STAI) score was useful for predicting hemodynamic responses during anaesthesia induction in non-cardiac surgical patients [[[77]](#endnote-77)] Moreover, levels of patient reported preoperative anxiety independently predicted the risk of mortality and major morbidity in patients aged >70 years undergoing cardiac surgery [[[78]](#endnote-78)]. A recent systematic review and meta-analysis, including 16 studies and 236,595 patients undergoing cardiac surgery, revealed that perioperative anxiety is associated with increased postoperative mortality [[[79]](#endnote-79)].

**Hospital stays:** The association between increased levels of preoperative anxiety and prolonged hospital stays and frequent readmission is also well established [[[80]](#endnote-80),[[81]](#endnote-81) ,[[82]](#endnote-82)].

Thus, preoperative anxiety has a negative impact on postoperative outcomes in patients [[[83]](#endnote-83)].

8. Measures of pre-operative anxiety

The measurement of preoperative anxiety in modern elective surgery is becoming very difficult, mainly due to the imposed time restrictions. A variety of objective and subjective methods are available for measuring preoperative anxiety.

1. Objective methods:

It includes indirect measurement of sympathetico-adrenal activity using heart rate and blood pressure or skin conductance. [[[84]](#endnote-84),[[85]](#endnote-85)] Plasma cortisol, urinary catecholamine excretion, and plasma catecholamines have been used as more direct measures of sympathetico-adrenal activity[[[86]](#endnote-86),[[87]](#endnote-87),[[88]](#endnote-88)]  
Nisbet *et al*. measured and displayed changes in electrical skin potential and suggested that these changes provide a continuous record of one sign known to vary with anxiety and sedation. [[[89]](#endnote-89)] In a study by Martinez *et al*., in thirty patients scheduled for elective surgery emotional responses before anaesthesia and surgery and the sedative effect of drugs used for preoperative medications were estimated by the measurement of urine catecholamines. Values of 20 ng/min of adrenaline in the urine were considered indicative of significant emotional tension. [[[90]](#endnote-90)] Fell *et al.* assessed the value of measurement of plasma catecholamine concentration as an objective index of anxiety. A study was performed on 48 surgical patients who were asked to rate their perceived anxiety on the linear analogue scale immediately before premedication and immediately before induction of anaesthesia. There were no significant changes in perceived anxiety or plasma noradrenaline concentration following premedication. However, compared with values before premedication, there was a mean percentage increase in plasma adrenaline concentration of 40% before induction of anaesthesia.

So, the measurement of plasma catecholamine concentration may be a useful method for the objective assessment of anxiety in the period before the operation and for assessing the efficacy of different preoperative medications. [[[91]](#endnote-91)]

2. Subjective methods:

It includes Spielberger’s State Trait Anxiety Inventory (STAI), [[[92]](#endnote-92)] Amsterdam Preoperative Anxiety Information Scale (APAIS) [[[93]](#endnote-93)], Hospital Anxiety and Depression Scale (HADS) [[[94]](#endnote-94)], Multiple Affect Adjective Check List (MAACL), Visual Analogue Scale for Anxiety (VAS-A), Hamilton anxiety rating scale (HAR) [[[95]](#endnote-95)].

9. Strategies to Mitigate Preoperative Anxiety and Improve Postoperative Outcomes

Current strategies for managing preoperative anxiety include both medical and nonmedical interventions. [[[96]](#endnote-96)] Anaesthesiologists may prefer medical interventions, such as benzodiazepines, while nonmedical interventions require collaboration between anaesthesiologists, nurses, and surgeons. Many nonmedical strategies to reduce patient anxiety have been attempted; among these, music therapy and perioperative patient education have proven to be effective interventions. [[[97]](#endnote-97)] Communication therapy, including preoperative education, is helpful in alleviating fear and stress. [[[98]](#endnote-98)]

Long wait times before surgery, with little information, add to the degree of anxiety. Anxious patients felt that their concerns were not fully or clearly responded to and complained frequently about insufficient information, inadequate respect, and insufficient empathy. [[[99]](#endnote-99)] These factors increase anxiety among patients and their family members.

**Communication session:** The findings suggested that preoperative communication is not the same as simply informing patients of the risks of surgery or anaesthesia, nor is it comprehensive and detailed medical knowledge. It is conceivable that some individuals do not want as much information as others; thus, a framework of general information should be established for individuals, and more opportunities should be provided for patients in terms of focusing on their real needs. [[[100]](#endnote-100)] Effective and sound preoperative communication provided by medical staff requires patience, empathy, and skills, and should be implemented based on individual cultural background, language, and religious preferences. [[[101]](#endnote-101)]

Good communication and extensive preoperative counselling can alleviate mental stress and reduce moderate to severe anxiety in patients. [[[102]](#endnote-102),[[103]](#endnote-103)] The anaesthesiologist’s visit, the surgeon’s interview, and the nurse’s attention are all indispensable for doctor-patient communication before surgical procedures, providing multiple opportunities to dispel doubts and moderate anxiety. In a study conducted by Maghsoodi, Zarea and Haghighizadeh (2014, p. 1) found that the establishment of therapeutic communication sessions with patients is effective in reducing the severity of their anxiety. The authors also showed that the communication and therapeutic relationship with the patient in the more purposeful manner can speed up the recovery process. It is during communication, a patient and a nurse interact, and a patient expresses his/her feeling and nurse help a patient to cope with the stressful situation. This finding is supported by the results of a study called impact of doctor- patient communication on preoperative anxiety conducted by Nikumb *et al.* (2012, p. 19) which found that better doctor-patient communication is associated with lower anxiety.

Humor can be used in perioperative setting to create relationships, decrease anxiety, release anger in a socially accepted way, avoid painful feelings and facilitate learning. When humor is used by a nurse a therapeutic atmosphere which increases the likelihood of a more positive surgical experience is established (Davis-Evans, 2013, p. 359).

**Music therapy:** Music therapy is also a simple and accessible intervention with proven effectiveness in reducing preoperative anxiety. [[[104]](#endnote-104),[[105]](#endnote-105)] A previous study found that exposure to music significantly reduced self-reported anxiety preoperatively, intraoperatively, and postoperatively, and improved patients’ experience of cataract surgery. [[[106]](#endnote-106)] Listening to music can reduce sympathetic nervous activity, allowing patients to relax emotionally and physically. [[[107]](#endnote-107)] Playing pleasant music on headphones can also mask annoying noises existing in medical settings and distract patients from the anxiety induced by auditory stimuli. [[[108]](#endnote-108)] In addition, exposure to music has been found to significantly reduce analgesic and sedative consumption [[[109]](#endnote-109)], relieve postoperative pain [[[110]](#endnote-110)] and improve patient satisfaction [[[111]](#endnote-111)], which may be associated with reduced anxiety. Interestingly, the genres and types of music also need to be considered. A clinical trial concluded that classical Western music was more effective in reducing anxiety during dental surgery, compared with Turkish music and soft rock music [[[112]](#endnote-112)]. As the popularity of mobile phones has made listening to music more convenient than ever, this strategy is worthy of further research. Although research has shown the benefits of personalizing one’s favourite music, professional psychologists should make appropriate recommendations regarding the type of music and a single cycle versus switching tracks for music therapy.

In a study conducted by Kushnir, Friedman, and Ehrenfeld (2012, p. 121) coping with preoperative anxiety in caesarean section, they found that listening to favourite music immediately before a caesarean section is effective for reducing anxiety. They explained that music may orient the patient’s attention away from negative stimuli to something familiar and soothing, thus promoting relaxation and changes in physiological responses. The findings showed that the women listened to their favourite music before caesarean section reported an increase in positive emotion and decrease in negative emotion and perceived the situation less threatening compared to women who did not listen to the music. Negative emotions cause specific action tendencies (fight or flight) while the positive emotions broaden the scope of attention, cognition, and action.

Similarly to this study Johnson, Raymond and Goss (2012, p. 154) in their study perioperative music or headsets to decrease anxiety found that music is an inexpensive, easy to administer and satisfier of most people intervention to decrease anxiety and Wakim, Smith and Guinn (2010, p. 231) in their study entitled the efficacy of music therapy found that listening to music correlated with lower anxiety, lower blood pressures, lower respiratory rates, and lower heart rates but they stressed on allowing the patient to choose his or her preference for the type of music or even bringing a portable music device from home.

**Preoperative education:** Guo, East and Arthur (2012, p. 58) found that preoperative education is effective in reducing the levels of anxiety and Pereira, Figueiredo-braga and Carvalho (2016, p. 733) found that an empathic patient-centered approach significantly reduces the anxiety, improves surgical recovery and wound healing and raises the satisfaction of the patient with the quality of the information provided. In this approach the patient is encouraged to express his or her feelings and psychological support and tailored information are provided to the patient and the patient’s questions are addressed in a calm, supportive and confident manner within an atmosphere of privacy, care, concern, with a non-judgmental and respectful attitude.

In addition, Kalogianni *et al.* (2016, p. 447) found that anxiety and postoperative complications were reduced in patients undergoing cardiac surgery due to preoperative education delivered by nurses and Maheshwari and Ismail (2015, p. 197) found that patients gaining information from anesthetists were less anxious than patients receiving information other than anesthetist. Moreover, Ebirim and Tobin (2010, p. 3) reported that postponement was the most common reason for anxiety and Homzová and Zeleníková (2015, p. 323) reported postponement among the factors associated with anxiety.

Some study indicated that providing an audiotaped recording of the consultation before cardiac surgery improved patients’ knowledge and perceptions of control over their health status, thereby reducing anxiety and depression. [[[113]](#endnote-113)] However, a review of randomized controlled trials evaluating the effects of preoperative education on anxiety and clinical outcomes in cardiac surgical patients showed inconsistent results. [[[114]](#endnote-114)]

**Family support and medication:** Support from family, friends, and health care providers and anxiolytic or antidepressant medications can help with relieving severe anxiety but the medications are associated with risks of potential side effects, dependence and withdrawal (Guo, East, and Arthur, 2012).

In addition, other strategies such as using essential oils, watching television, and using relaxation techniques have been considered as alternatives to relieve anxiety, but little reliable evidence is currently available for these [[[115]](#endnote-115),[[116]](#endnote-116)].

10.Studies on pre-operative anxiety:

Various studies have been done to measure the preoperative anxiety using different scales. Millar *et* *al*. compared the three measurements of anxiety to determine their equivalence in assessing anxiety before surgery. Forty-four patients awaiting breast cancer surgery completed the state scale of the STAI, the HAD scale, and a 100 mm VAS. The authors concluded that the scales were equivalent in their assessment of anxiety before surgery, but the reference to normative data was important in establishing such equivalence and in determining the patient's state. [[[117]](#endnote-117)]  
  
Hicks *et* *al*. assessed preoperative anxiety using HAD scale, MAACL, and LAAS in 100 consecutive day care patients undergoing the termination of pregnancy. The HAD scale was readily accepted and easily understood by the patients. There was a high degree of correlation between the HAD scale and both the MAACL (correlation coefficient 0.74) and LAAS (correlation coefficient 0.67). There was only a moderate degree of correlation between the HAD scale and the anaesthetist’s assessment of anxiety (correlation coefficient 0.46) and concluded that HAD scale is a useful method of subjective measurement of preoperative anxiety [[[118]](#endnote-118)].  
Facco *et* *al*. validated VAS-A in pre-anaesthetic evaluation [[[119]](#endnote-119)]. Kindler *et* *al*. studied anxiety in 734 patients by means of VAS and the State Anxiety Score of the Spielberger STAI. The mean STAI anxiety score was 39 ± 1 (*n* = 486) and the mean VAS for fear of anesthesia was 29 ± 1 (*n* = 539). Patients feared surgery significantly more than anesthesia (*P* < 0.001). The VAS measuring fear of anaesthesia correlated well with the STAI score (*r* = 0.55, *P* < 0.01). Young patients, female patients, and patients with no previous anesthetic experience or a previous negative anaesthetic experience had higher anxiety scores. Patients worried most about the waiting period preceding surgery and were least concerned about possible awareness intraoperatively [[[120]](#endnote-120)].  
Hernandez-Palazon *et* *al*. carried out a prospective longitudinal study on 300 cardiac surgery patients. The patients were assessed regarding their preoperative anxiety level using VAS-A, APAIS, and a set of specific anxiety-related questions. Ninety-four percent of the patients presented preoperative anxiety with 37% developing high anxiety (VAS-A ≥7). The preoperative length of stay >2 days was the only significant risk factor for preoperative anxiety. A positive correlation was found between anxiety level (APAISa ) and requirement of knowledge (APAISk ). APAISa and APAISk scores were greater for surgery than for anesthesia. In addition, the results showed that the most common anxieties resulted from the operation, waiting for surgery, not knowing what is happening, postoperative pain, awareness during anaesthesia, and not awakening from anaesthesia [[[121]](#endnote-121)].  
Maheshwari *et* *al*. evaluated preoperative anxiety in patients selecting either general or regional anaesthesia for elective caesarean section. The overall rate of anxiety was observed in 72.7% (112/154) patients. The rate of anxiety was significantly high in patients of general anaesthesia group as compared to regional anaesthesia group (97.2% [69/7] vs. 51.8% [43/83]; *P* < 0.01). A statistically significant association with preoperative anxiety (VAS ≥50) was observed with factors such as age <25 years, working women, nulliparous and primi-parous, no previous anaesthesia experience, having previous anaesthesia experience under general anaesthesia, and those having their source of information from non-anaesthetists. The authors concluded that anxiety was one of the reasons for refusing regional anaesthesia and suggested that every patient coming for the elective caesarean section should be assessed for the presence of anxiety in their routine preoperative anaesthesia assessment. This measure may help to reduce the anxiety and assist in making a rational decision regarding their choice of anaesthesia technique [[[122]](#endnote-122)].

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