

Psychological interventions for pain and anxiety management during bone marrow aspiration and biopsy

Intervenciones psicológicas para el manejo del dolor y ansiedad durante el aspirado y biopsia de médula ósea

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Abstract:

Cancer is the second cause of death in the world and the fourth in Mexico, among its types, are onco-hematological diseases. Having cancer will have several repercussions on people suffering from it, including having to undergo very painful medical-invasive procedures, such as aspiration and bone marrow biopsy, a gold standard for the diagnosis of these pathologies. Bone marrow aspiration and biopsy anxiety are common, which increases pain and makes it a traumatic experience. Pharmacological strategies have not been entirely effective when it comes to pain management, so other solutions such as psychological interventions have been sought (psychoeducation, mindfulness and distraction techniques such as music therapy, self-directions, breathing techniques, and relaxation, use of virtual reality and mobile applications). Psychological interventions have proven to be effective in managing pain and anxiety, however, for patients to have access to them, it is necessary to include the psychologist as part of the multidisciplinary team during the performance of these procedures.

Keywords:

Aspiration and bone marrow biopsy, anxiety, pain, psychological interventions, onco-hematological diseases

Resumen:

El cáncer es la segunda causa de muerte en el mundo y la cuarta en México, entre sus tipos se encuentran las enfermedades onco-hematológicas. El padecer cáncer va a tener varias repercusiones en las personas que lo padecen, entre ellas, tener que someterse a procedimientos médicos-invasivos muy dolorosos, como es el caso del aspirado y biopsia de médula ósea, estándar de oro para el diagnóstico de estas patologías. La ansiedad ante el aspirado y biopsia de médula ósea es común, lo que incrementa el dolor y lo convierte en una experiencia traumática. Las estrategias farmacológicas no han sido del todo efectivas cuando del manejo del dolor se trata, por lo que se han estado buscando otro tipo de soluciones como las intervenciones psicológicas (psicoeducación, mindfulness y técnicas de distracción como la musicoterapia, auto instrucciones, técnicas de respiración y relajación, uso de realidad virtual y aplicaciones móviles). Las intervenciones psicológicas han mostrado ser eficaces en el manejo del dolor y la ansiedad, sin embargo, para que los pacientes tengan acceso a las mismas, es necesario incluir al psicólogo como parte del equipo multidisciplinario durante la realización de estos procedimientos.

Palabras Clave:

Aspirado y biopsia de médula ósea, ansiedad, dolor, intervenciones psicológicas, enfermedades onco-hematológicas

In 2021 reports, cancer caused 10 million deaths in the world, that is, it is the second cause of morbidity and mortality and these figures are expected to increase.¹ 7.2% of these deaths were due to people who suffered some onco-hematological disease.²

INTRODUCTION

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Non-Hodgkin lymphoma is the twelfth type of cancer with the highest incidence worldwide, with 509,590 new cases, while leukemia ranks 14th with 437,033 new cases. Multiple myeloma ranked 23rd with an incidence of 159,985 cases and Hodgkin lymphoma ranked 27th with 79,990 new cases.³ Being the most popular types of hematological cancer.

In Mexico, malignancies were the fourth cause of death, with a total of 90,645 cases.⁴ Leukemias and non-Hodgkin lymphomas have also been identified as the type of cancer that causes the most deaths in people between 0 and 29 years old.⁵ According to statistics from Instituto Nacional de Estadística y Geografía, malignant tumors of hematopoietic organs in people aged 20 and over, are the second most common cause of morbidity in women than in men with 17.46 and 11.4% respectively.⁶

Given these statistics, cancer is considered a global public health problem that has a major impact on health institutions, since as a disease of great impact at national and global levels, institutions have great demand, in terms of diagnosis and treatment.^{7,8}

Receiving a diagnosis and treatment for cancer affects the patient physically (presents symptoms such as nausea, vomiting, pain, fatigue, and sleep problems) and psychosocial (with stress, fear, anxiety, depression, and economic and family problems) as it involves many changes, making it difficult to adapt to the disease.⁹

This paper aims to describe the psychological intervention techniques used to manage pain and anxiety during bone marrow biopsy and aspiration (BMBA), the gold standard for the diagnosis of onco-hematological disease.

DEFINITION OF ONCO-HEMATOLOGICAL DISEASE

Onco-hematological diseases are those malignant neoplastic pathologies that affect blood cells. The most common are leukemias mainly in men and children, lymphomas in both sexes of which non-Hodgkin lymphoma predominates and myelomas in all its variants.^{5,10}

BMBA AND ITS RELATIONSHIP WITH THE DIAGNOSIS OF ONCO-HEMATOLOGICAL DISEASE

Hematopoiesis originates in the bone marrow, that is, the process in which cells differentiate and mature in the production of blood cells (erythrocytes, thrombocytes, and leukocytes), important for oxygenation of the blood, for coagulation and the immune system.^{11,12}

To diagnose a person with a hematological, benign, or malignant disease, as well as to evaluate the effects of treatments, various blood and bone marrow studies are used. BMBA is used for

cytogenetic analysis, flow cytometry, and molecular studies, being a safe and economical way to analyze cells in a semi-quantitative and qualitative manner.¹³ It is fast, and it is obtained without major risk and with minor discomfort, so it has become the most important medical test of confirmatory hematological diagnosis.¹⁴

When by the signs, symptoms, and clinical history, it is suspected that the patient suffers from some hematological disease, the performance is prescribed, either only the aspiration or accompanied by bone marrow biopsy, with the intention of determining which type of hematological disease corresponds.¹⁵

The aspiratoin works to observe cell morphology and biopsy to quantify cells and diagnose infiltrative diseases of the bone marrow.¹⁶

To obtain the sample, fluid is removed from the bone marrow (aspirated) or a piece of bone (biopsy) with a special needle, usually from the posterior iliac crest or sternum. While anesthesia is used to do the procedure, it is not enough to avoid pain.^{14,15,17}

BONE MARROW BIOPSY AND ASPIRATION TECHNIQUE

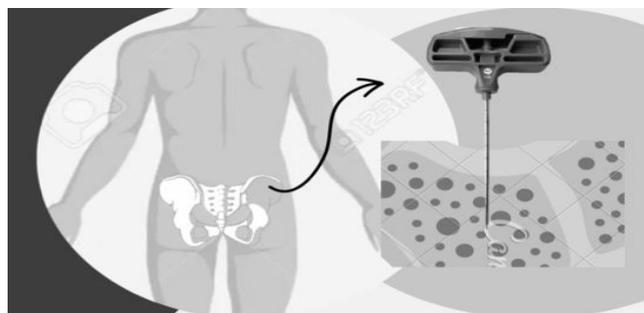
The first step in performing a bone marrow aspiration and/or biopsy is to know your medical history, do a physical exam, and use other tests such as a peripheral blood count. It is of great importance to identify if the patient has any contraindications for its performance, for example in the biopsy it may be haemophilia, severe disseminated intravascular clotting among other severe bleeding disorders.¹⁸ As a second step, the puncture site is chosen, the most common and favorite among doctors is the posterior iliac crest, although it can also be performed on the anterosuperior iliac crest in children over 2 years of age and in adults, on the anterior tibia in premature children and before 18 months since there is not yet a complete formation of the iliac bone or the sternum, however, this site is contraindicated in children, due to the risk of complications, because if in an adult this anatomical part measures 1cm, it is smaller in children, which makes it more likely for penetration of the chest cavity to happen, causing serious cardiopulmonary consequences; and no biopsies can be performed at this site. The next step is to place the patient in the proper position based on the site where it will be performed and prepare the needles, syringes of 10 to 20 ml, lidocaine, antiseptic solution, laboratory tubes, and a sterile field.^{15,18,19}

For the aspiration, it is necessary to clean the area where it is to be performed, it will be evaluated whether a general or local anesthesia will be performed. In the case of local anesthesia, lidocaine is administered, that is, anesthesia is injected, you must wait a moment for it to take effect and insert the needle perpendicularly to the bone, pressure is maintained and rotary

movements are made. Once the needle is in the medullary cavity it must be kept fixed, it is aspirated with syringes until the appropriate sample quantity is obtained, in this step, the individual may experience pain for a few seconds. The sample is placed in laboratory tubes, at the end of the procedure pressure is applied to the area where the procedure was performed and then a sterile gauze is placed. Sometimes a "dry aspirate" occurs, that is to say, that at the time of aspiration, no marrow is obtained, which involves deepening the puncture or redirecting the needle (it is a blind procedure), this can also be due to fibrosis, hypocellularity, aplasia, metastasis, etc., in this situation, only a biopsy can be obtained.^{18,19}

In the case of biopsy, the procedure is the same, but the needle is rotated and a piece of about 5 mm of bone is removed.^{18,19} It is essential to consider some more aspects such as; if it were performed unilaterally and only aspirated in the case of leukemia or immune thrombocytopenic purpura or if it was bilateral and with biopsy recommended in lymphomas or solid tumors. Both the aspiration and the biopsy of the bone marrow are complementary studies, since each one is useful in studying something specific, for example, in the aspirate, it allows us to know a detailed cellular recognition, while in the biopsy a recognition of the structure is obtained. This is usually normal or abnormal.¹⁹

Figure 1. Bone marrow aspirate and biopsy technique.¹⁸



Source: self made

This procedure has advantages such as that it is easy and safe, because, in expert hands, the risks are very mild and with minor discomfort, and it is processed quickly.¹⁴ However, it also presents disadvantages such as complications arising from its performance such as pain at the site of the puncture, bleeding, and infection in the incision. If performed in the breastbone, there is a risk of serious cardiovascular complications, but it rarely happens.¹⁸

PAIN, THE MAIN CONSEQUENCE OF BONE MARROW BIOPSY AND ASPIRATION

Pain is "an unpleasant sensory and emotional experience associated with an actual or potential injury, described in terms of such injury".¹⁹

According to some studies, most people who undergo BMBA experience pain.¹⁵ Some patients report that it is the second cause of pain after the disease others that was their worst disease-related experience and treatment.^{20,21,22}

As reported by a study, 50 to 70% of participants who underwent BMBA identified moderate to unbearable pain.²³ In another study, 70% reported having pain, of which 30% reported severe pain, the worst they had experienced in their lives.²⁴

The phase of the procedure that causes more pain is just the moment of aspiration and is more intense in young people than in older people. The reasons why the pain may increase are 1) that the procedure is prolonged, 2) that it is performed by an inexperienced doctor, 3) that it is the doctor who provides information about BMBA, 4) that the patient has a high Body Mass Index (BMI) and 5) that BMBA is performed on the breastbone.²⁵⁻²⁷

As suggested, pain is a multifactorial phenomenon determined by socio-demographic, physical and psychological factors, for example anxiety is one of those factors.^{17,26}

ANXIETY AS A PREDICTOR OF PAIN

Anxiety is the emotional state that arises from a stimulus, which in the past, was associated with an aversive stimulus, resulting in a change in the body (breathing, heart rate, urination, etc.).²⁸ As well as the anticipation of harm or misfortune manifested with dysphoria and tension, related to fear and worry.²⁹

Anxiety derived from BMBA can be explained by the model of conditioned anxiety, which explains that anxiety is learned through conditioned stimuli that have previously been paired with situations of damage or pain, for example, needles (neutral stimulus) are associated with an aversive stimulus (pain) causing anxiety (tachycardia and sweating), later, the neutral stimulus will cause the learned response.³⁰⁻³³

A strong correlation has been identified between anxiety and the intensity of pain, even anxiety can be assured as a predictor of pain.^{25,26,34-37} This is important since this procedure is recurrent during the treatment and surveillance phase; painful previous experiences have been observed to cause more anticipatory anxiety, making subsequent approaches equal or more painful.²⁷ Anxiety in BMBA may be related to the procedure itself or the results of this.^{25,26.}

PSYCHOLOGICAL INTERVENTIONS

Pharmacotherapy has not proven to be the most effective solution for pain management during BAMO, since it has negative side effects such as nausea, vomiting, respiratory complications, etc. Strategies such as the use of local anaesthesia

relieve pain when the needle is inserted, but not when the aspiration is performed.^{13,23,26,37} Therefore, it is of utmost importance to identify alternative methods that decrease pain and anxiety.

Non-pharmacological strategies can have good results in reducing pain and anxiety.^{23,27,38-44} Strategies such as psychoeducation, cognitive-behavioral therapy, music therapy, distraction techniques, etc. have been used.⁴²

PSYCHOEDUCATION

When the medical staff is honest and provides accurate information with understandable language, it generates confidence in the patient, which decreases anxiety and therefore pain. In a study analyzing interventions to reduce anxiety, it is pointed out that providing clear, accurate, and adequate information about his disease, treatment, and medical procedures in this case of biopsy or aspiration of the marrow to individuals is indispensable for the reduction of anxiety levels.^{41,42}

DISTRACTION TECHNIQUES

Distraction techniques have been empirically shown to be useful for pain and anxiety management, in a narrative review study, the effects of the distraction technique concluded that in most studies a significant decrease in pain.^{38-40,43,45} These techniques involve the five senses to focus user attention on other stimuli, that is to divert attention to another point, to other stimuli in order to reduce levels of anxiety and pain.^{41,46}

MUSIC THERAPY

In music therapy, sounds and landscapes are combined, which distracts the patient, and causes anxiety and pain to be reduced.⁴⁵ In Turkey, a study was conducted on 30 patients submitted to BMBA (14 in the experimental group and 16 in the control group) to identify the effect of Turkish classical music on anxiety and pain. Finding that anxiety increased after intervention in both groups, being statistically significant in the intervention group ($p < 0.05$). Pain was significantly lower ($p < 0.05$) in the intervention group than in the control group.⁴⁷

SELF-VERBALIZATION

Metacognitive strategies are used to promote self-control and confidence in one's abilities. They serve to prepare the individual to use more complex self-instructions, focus attention on an activity to be executed, reinforce a behavior or provide feedback, orient a behavior, and lower anxiety.⁴⁸

Self-instructions or self-verbalizations are based on positive self-dialogue, which, is conceptualized as an internal monologue of structured phases, how people react to a situation depends on

this. It can be motivational, instructional, self-assertive, and related to an emotional state.⁴⁹ Self-dialogue not only decreases anxiety but also improves self-efficacy.⁵⁰

Self-directions have been used successfully in hospital settings to deal with invasive medical procedures, it is usually a complementary technique to cognitive behavioral interventions, proving to be effective within behavioral medicine, especially in the field of health.⁵¹ In some studies conducted in children during painful dental interventions verbalizations such as "I'll be fine in a while" and "everything will be fine". At first, they were used aloud for later, just thinking about them. The children remained calm and were not anxious, this was observed in psychological interventions, especially in the hospitalization phase.^{52,53}

The fact that patients raise their self-verbalizations facilitates the handling of pain-generating emotions. This technique could be used to relax patients when the use of guided imagery is not able to reduce anxiety.⁵⁴

In the specific case of the BAMO, distracting self-verbalizations are used (e.g. "concentrate on your breathing"), as support, which instills courage (for example "I am brave and I can with this") and to minimize the annoyance of the situation (e.g. "I will do it for my health").^{55,56}

Autoverbalizations help cognitive self-control, which has given good results when dealing with situations that produce high levels of anxiety.⁵¹

USE OF VIRTUAL REALITY

It is also used as a distraction technique. It is based on the idea that people cannot analyze several stimuli at the same time. With the use of virtual reality lenses, it allows the person to concentrate on more pleasant stimuli and not those that cause anxiety such as the preparation of materials for BMBA or the needle penetrating the skin and bone.⁴⁰

Better results have been observed with the use of virtual reality versus nonvirtual reality on a computer screen to control anxiety and pain in cancer patients. There is robust evidence of the effectiveness of virtual reality as a distracting technique, mainly during painful medical procedures.⁴⁰

In this investigation, reality lenses were used before starting the BMBA, they could choose three scenarios, one with nature (palm trees that move and streams), trees, or marine life that would be projected during the 15 minutes of the procedure. It also contained soothing music. The intervention was tested on 97 adult cancer patients, divided into an experimental group ($n=49$) and a control group ($n=48$). The experimental group was not found to have a significant decrease in pain and anxiety. Both

groups showed a decrease in anxiety and pain levels in pre and posttest.⁴⁰

USE OF MOBILE APPLICATIONS

The use of apps can have good results for the management of anxiety and pain, mainly in children. In a randomized controlled trial, they tested an app that provided information on the procedure and effective coping strategies in a sample of 60 children who would undergo BAMO. The app contained sufficient and understandable information for school-age children about preparation, realization, and recovery after medical intervention, through animated videos and games to deal with anxiety. Anxiety decreased significantly ($p=0.001$). It was also significantly lower in the experimental group than in the control group ($p<0.01$).⁴³

BREATHING AND RELAXATION TECHNIQUES

Breathing and relaxation techniques are the most used since they decrease physiological activation, in other words, there is a reduction in blood pressure, heart rate, cortisol, and a less alert state, they intend to decrease the anxiety and tension that usually accompany the pain. Relaxation diverts attention from the painful experience, which helps decrease its intensity. Relaxation can be segmental, dividing the body into parts, or global, such as guided imagery. According to Jacobson's progressive relaxation technique, it has been shown that having good breath control greatly helps to reduce experiences that generate pain and anxiety.⁵⁷

In a quasi-experimental study where five children between 7 and 10 years of age were evaluated, it was concluded that the relaxation technique to reduce pain during invasive medical procedures, particularly in bone marrow aspiration and biopsy, the results were significant, since the data on pain intensity levels before the intervention were 5 and after the intervention ranged between 1-3, in a pain scale from 0 to 5.⁵⁸

MINDFULNESS

Mindfulness promotes self-regulation through awareness of pain sensations. Being aware of mental states are not permanent allows one to better tolerate unpleasant states. Accepting that you have pain reduces the avoidance of sensation. People who practice mindfulness feel less pain, have a better quality of life, and have fewer negative emotions. To train patients in this technique, they are asked not to judge their feelings, be patient, put aside previous experiences and expectations, have confidence, not strive to achieve something, accept and let go, and not hold on to things. In the study on the management of pain of sufferings in children, it was found that the implementation of mindfulness helps in the regulation of

attention and emotions, allowing a better coping with painful experiences.⁵⁷

CONCLUSION

Pain and anxiety are common problems when BMBA is treated, however, it is not something that is very often considered. Pharmacological strategies have not been effective in reducing discomfort, so it is necessary to look for other alternatives, such as psychological and psychopharmacological interventions, which, although they do not disappear, have proven effective in reducing it. Including the psychologist in the multidisciplinary team that performs these procedures could bring great advantages. It is important to continue carrying out research in this area, mainly in adult patients, as there are few studies focusing on the subject, since most of the research carried out on this topic is applied to children, that is why I suggest that it be resumed in adults.

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