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Effective pain reduction during bone marrow biopsy and aspiration – Technique over experience

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ABSTRACT

Background: Bone marrow biopsy and aspiration (BMBA) is a diagnostic procedure within the field of internal medicine. The intensity of the pain felt by the patients often goes unrecognized by the medical staff. No extant studies have addressed pain intensity experienced during each particular step of a BMBA. **Objectives:** The aim was to analyze the pain intensity and explore the extent to which the technique applied by the doctor performing the biopsy influences the pain level. **Methods:** A survey comprising 17 questions was created and it addressed characteristics of the patients, previous experience and pain intensity on each step of the procedure. **Results:** 125 patients were enrolled into the study. Age ($p = 0.009$), gender ($p = 0.02$), pain during previous biopsies ($p < 0.0001$) and adequate information ($p = 0.04$) were shown to have significant impact on the pain intensity levels. There was a significant difference in the pain levels on different steps of the procedure perceived by the patients, when comparing the doctors with similar experience performing BMBA ($p = 0.01$ to $p < 0.0001$ depending on the step of the procedure). **Conclusions:** The differences in the pain scores between the doctors are most likely caused by differences in technique of BMBA. The analysis of the individual technique of the doctors performing the least painful biopsies may give answers needed for educational intervention aimed at pain reduction during BMBA.

Introduction

Bone marrow biopsy and aspiration (BMBA) is an essential diagnostic procedure within the field of internal medicine, enabling bone marrow specimens to be collected for histopathological and cytopathological examination and immunophenotyping [1–3]. A BMBA can also be a painful procedure and a significant ordeal for many patients. The significance and importance of the patient's experience with BMBA remains unrecognized by many physicians [4]. There are no clear guidelines on how to reduce this pain,

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and the field remains under-researched. Furthermore, physicians underestimate the severity of the pain [5–7].

Research thus far has focused on the pharmacological reduction of pain using local anesthesia, usually Lidocaine or a similar agent [8]. Various trials have addressed other means of analgesia for the pain associated with this procedure, including pharmacological trials administering combinations of analgesics, sublingual fentanyl, intravenous sedation with benzodiazepines or, most recently, nitrous oxide/oxygen or nitrous oxide alone [9]. Alternative methods of reducing pain have also been investigated, including hypnosis as an adjunct to local anesthesia, cognitive behavioral therapy (shown to be ineffective), art/music therapy and contralateral ice massage during the procedure [9–12]. Recently, powered bone marrow-acquiring devices were tested and compared with the classical manual approach [9].

However, these studies have not addressed in detail one of the most important factors contributing to pain during the procedure, physician technique. To date, the findings have been contradictory as to whether the experience of the physician influences the pain experienced by the patients during biopsies. The results of some studies demonstrate lower perceived pain when experienced doctors perform BMBA, and other studies fail to show a difference [9]. No international guidelines have been proposed for techniques to minimize pain during BMBA, and this knowledge has typically been passed from older to younger doctors. Moreover, the pain analyses in extant studies are relatively inaccurate; patients are typically asked for their general pain sensation during the procedure. The BMBA includes several stages: anesthesia, entering the bone with the needle, bone marrow aspiration and bone extraction; each stage can be characterized by a distinct intensity of pain [4]. Because each of the steps depends on the technique applied by the operator performing the biopsy, the question arises: Will experienced operators differ from each other in the way that they perform a biopsy? The aim of this study was to analyze for the first time the pain felt by patients during various stages of the BMBA. Moreover, we wanted to identify which factors influence pain during the various stages and, most notably, the extent to which the technique applied by the doctor performing the biopsy influences the pain level.

Material and methods

The study was conducted at the Department of Hematology, Oncology and Internal Medicine at the Medical University of Warsaw. All patients over 18 years of age who were scheduled for a BMBA were offered enrollment into this study between 2011 and 2013. Only the patients who signed informed consent were asked to fill the questionnaires. Otherwise there were no other inclusion or exclusion criteria. The study design was approved by the Bioethics Committee of the Medical University of Warsaw. The doctors performing the biopsies in this study were typically hematologists or hematologists-in-training, and they all had a high level of experience performing BMBAs (per doctor the number performed ranged from a few hundred to a few thousand).

The various parts of the procedure and the pain intensity experienced by the patients were assessed by creating a 17-question survey. The questions included patient general characteristics (age, weight, height and occupation), the history of previous BMBA (number and pain intensity of previous procedures) and whether any premedication was taken. One crucial question included 7 sub-questions that addressed the pain intensity during each step of the BMBA. We asked for the level of pain intensity before the procedure and during local anesthesia administration, biopsy needle insertion through soft tissues, biopsy needle insertion through the bone, bone marrow aspiration and, if applicable, bone extraction. We asked the patient to report the pain intensity experienced after the procedure. Other questions solicited information regarding whether the pain experienced during each step was significant (intolerable) and what point on the Visual Analogue Scale (VAS) signified pain intensity that was considered intolerable. General satisfaction, environmental factors, the doctor's approach and whether enough information was provided about the procedure were also assessed. Finally, patients were given the opportunity to express their own thoughts on factors influencing pain and possible ways of reducing it.

As the questionnaire addresses the pain on different stages of procedure which can be forgotten or not understood by patients we run a pretrial quality check of questionnaire. Questionnaires were consulted with patients and their opinion was asked on possible problems with assessment of the pain on different stages of biopsy. The patients did not report any difficulties in filling the questionnaire which was later approved for the study.

All assessments of pain intensity were made using the Visual Analogue Scale (VAS), a 100 mm horizontal baseline anchored with 2 descriptions, “no pain” on the left-hand side and “worst imaginable pain in my life” on the right-hand side [13, 14]. The questionnaire was administered to the patient immediately after the procedure, and the patients were asked to return it as soon as possible before leaving the clinic. The surveys were reviewed, edited and approved by all authors. All data obtained were analyzed using Akademistatistik, Sahlgrenska Academy, Gothenburg University, Sweden.

The BMBA procedure was conducted with the patient in a supine position for sternal biopsies or prone for biopsies of the iliac crest. Aseptic technique was employed, and the area was scrubbed and draped with the sampling site exposed. The choice of biopsy site, the sternum or spina iliaca, was made by the physician performing the procedure according to the clinical indications for each patient. If only a marrow aspiration was required, the sternal site was preferred.

A local anesthetic, 2% Lidocaine, was injected subcutaneously at the sample site: up to 2 ml for the sternum and up to 10 ml for the spina iliaca, depending on the effect of the anesthetic. A few minutes after injecting the Lidocaine, the doctor gently tapped the bone with the tip of the needle while asking the patient to report any painful sensations to assess the efficacy of the local anesthesia. The sternal biopsies were made with 15 G × 5–30 mm bone marrow aspiration needles, and the trephine biopsies were made with 11 G × 100 mm Jamshidi-type needles.