Bone Marrow Aspiration, Bone Marrow Biopsy, Bone Lesion Biopsy

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This abstract presented at the 2013 American Society of Pediatric Hematology/Oncology Annual meeting describes a randomized study comparing bone marrow biopsy and aspiration procedures performed using the traditional manual device and the powered OnControl device in pediatric patients. The authors concluded that OnControl biopsies were obtained safely, in less time, and in good quality compared to those obtained using traditional manual devices and that the benefits may lead to reductions in anesthesia time and overall cost. This study was sponsored by Vidacare Corporation.


This retrospective study evaluated the diagnostic value of MRI guided percutaneous musculoskeletal biopsy and the value of fine needle aspiration biopsy when combined with histologic biopsy in 172 procedures. The authors concluded that MRI guidance produced greater diagnostic accuracy than trepnie biopsy and fine needle aspiration biopsy when each are used alone.


This abstract presented at the 2013 World Conference on Interventional Oncology describes a retrospective review of 64 patients who underwent biopsy procedures performed by one interventional radiology group. The authors concluded that the device was especially useful for hard bones and difficult to reach lesions, resulted in shorter procedure times with less physician effort, and that use of the device resulted in larger/higher quality specimens, a broader spectrum of potential users, and reduced radiation exposure to patients and clinicians. This study was sponsored by Vidacare Corporation.


This pre-clinical study sought to characterize aspiration artifact in the bone marrow to determine the distance from the aspiration site at which artifact would not be observed. Bone marrow aspiration of 3ml, 4ml, and 10ml were performed in the iliac crest with biopsy specimens collected in 0.5 cm intervals from the aspiration site. The iliac crest surrounding the 10 ml aspiration site was excised for evaluation. Results showed that none of the collected specimens demonstrated aspiration artifact. When evaluating the excised bone, it was noted that the artifact symmetrically affected an area of 0.4 cm wide and 1.6 cm deep; a calculated 0.2ml defect. This study was sponsored by Vidacare Corporation.


This article evaluates the correlation between bone marrow aspirate and biopsy results in 51 patients with NHL that received both procedures simultaneously. They found that the agreement level was 80% for this patient population, with discrepancies in 20% of cases evaluated.


This abstract describes a 50-patient study that compared the powered device to the traditional manual technique by relatively assessing pain scores, procedure times, biopsy capture rates, quality of material retrieved, safety and operator satisfaction. Results suggest that the use of a powered bone marrow biopsy device significantly reduces needle insertion pain. Moreover, the superior size and overall quality of core specimens retrieved by the powered device provides more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures. This study was sponsored by Vidacare Corporation.


This article provides a detailed overview of bone marrow aspiration and biopsy from initial patient visit through processing and reporting.


Compares the diagnostic impact of bone marrow cytology in combination with flow cytometry analysis of aspirate smears and bone marrow histology together with immunohistochemical examination of trephine biopsies. Diagnoses between aspirate and biopsy were concordant in 80.5% cases.


The objective of this study was to evaluate the efficacy of bone marrow aspiration as compared to bone marrow biopsy for the purpose of disease diagnosis. Of 420 consecutive cases, aspiration alone was sufficient in making a diagnosis in 372 (88.6%). In the remaining cases bilateral biopsy was required to reach a diagnosis.
YEAR: 2001


This article provides a general overview of bone marrow aspiration including, indications and areas of controversy, site and technique, processing, and reporting.

YEAR: 1997


This article describes a 10 year study of 4,902 patients receiving bone marrow procedures to assess the value of specific components. Investigators concluded that bilateral aspirates with biopsies are needed for diagnosis in staging for neoplasms, and that a unilateral aspirate with biopsy is sufficient to assess patients with cytopenia and leukemia.

YEAR: 1992


This article examines the role bone marrow aspirate and core biopsy play in diagnosis and regular monitoring of acute myeloblastic leukemia (AML), megakaryoblastic leukaemia and acute myelofibrosis, acute lymphoblastic leukemia (ALL), myelodysplastic syndromes (MDS), and chronic myeloid leukemia (CML). The authors conclude that a core biopsy specimen complements the peripheral blood and marrow aspirate findings in providing additional information for the diagnosis and assessment of prognosis.

YEAR: 1989


Fixed biopsy samples from 125 multiple myeloma patients were reviewed according to morphological and immunohistological criteria. Comparison of the findings of biopsies and aspirates, the aspirate sample lead to an underestimation of the tumor burden in 30% of cases.

YEAR: 1988


This article describes a study involving 256 bone marrow biopsy procedures, in which biopsy specimens were compared with peripheral blood smears and bone marrow aspirates. Researchers concluded that when blood and aspirate samples fail to indicate the diagnosis, a long-core biopsy may provide positive results.

YEAR: 1976


This abstract describes the review of records at memorial Sloan-Kettering Cancer Center evaluating biopsy and aspirate testing. Supports both aspiration and biopsy are indicated for full evaluation of bone marrow in cancer patients.

YEAR: 1974


Evaluation of 205 simultaneously collected bone marrow biopsy and aspirate specimens from patients with lymphoma, leukemia, and a variety of solid tumors. Specimens were evaluated for adequacy, number of positive biopsies, and disparity between biopsy and aspirate.

This article provides a general overview of the process of iliac crest bone biopsy including the indications, preparation, instrumentation, and potential complications, with a focus on use of the procedure for diagnosis and treatment of renal osteodystrophy.


This abstract describes use of the powered OnControl Bone Access System with coaxial needles to perform 12 consecutive biopsy procedures of lytic and sclerotic bone lesions. A pathologist was present to provide assessment of the initial specimens and all were of adequate volume/cellularity. One complication of asymptomatic pneumothorax was reported; a precautionary chest tube was placed. The authors concluded the powered biopsy system/co-axial needle set reliably yields multiple large biopsy specimens of adequate cellularity.

Symington K, Martinez F, Miller LJ, Philbeck T. Examination of 64 consecutive specimens obtained using a powered biopsy device. JVIR 2014;25(3s):S196

This abstract describes the initial experience of one radiology group’s use of the powered OnControl system to perform biopsy of focal bone lesions and bone marrow aspiration/biopsy. The authors concluded that the powered system results in higher quality specimens, easier and faster performance of biopsy, a broader spectrum of potential users, and reduced radiation exposure to patients and operators, turning previously inaccessible focal lesions into potential biopsy targets.


This abstract presented at the 2013 World Conference on Interventional Oncology describes a retrospective review of 64 patients who underwent biopsy procedures performed using the OnControl system by one interventional radiology group. The authors concluded that the device was especially useful for hard bones and difficult to reach lesions, resulted in shorter procedure times with less physician effort, and that use of the device resulted in larger/higher quality specimens, a broader spectrum of potential users, and reduced radiation exposure to patients and clinicians. This study was sponsored by Vidacare Corporation.

This article describes a cadaver study comparing the perpendicular and lateral approaches for performing bone marrow biopsy procedures in the posterior iliac crest to determine if one approach is preferred. The cadavers were placed in the left and right lateral decubitus position for the procedures; the manual Jamshidi and powered needles were used. The needle pathways for each approach were evaluated under CT and the bone was dissected to evaluate structural damage. The authors found that continued advancement of the needle with the perpendicular approach was associated with an increased likelihood of injury to nearby arteries and nerves, and the sacroiliac joint with inadvertent penetration of the inner cortex. The lateral approach was found to be significantly less likely to result in neuro-vascular damage or trauma to the sacroiliac joint. The authors also note that the lateral approach yields significantly longer specimens though the data collected is limited and not specified in the article.


Prospective study of cancer patients evaluating the characteristics and determinants of procedure-related pain, with bone marrow aspiration/biopsy (BMA) as the procedure. 70% of patients reported moderate to severe pain. Predictors of pain during BMA were identified which may help identify patients in need of complementary interventions to alleviate pain.


This article describes a follow up study to a prior study conducted by the same group of investigators (Reid 1996) evaluating the adequacy of bone marrow biopsy specimens obtained from children. Specimens obtained from 25 different centers were evaluated by a central pathologist and graded for adequacy. Of 605 specimens collected from 150 children with neuroblastoma, 154 specimens (25%) were deemed inadequate. The authors concluded that local initiatives involving active and direct feedback from reporting pathologists should be employed to influence operators.

Symington K, Martinez F, Miller LJ, Philbeck T. Examination of 64 consecutive specimens obtained using a powered biopsy device. *JVIR* 2014;25(3s):S196

This abstract describes the initial experience of one radiology group’s use of the powered OnControl system to perform biopsy of focal bone lesions and bone marrow aspiration/biopsy. The authors concluded that the powered system results in higher quality specimens, easier and faster performance of biopsy, a broader spectrum of potential users, and reduced radiation exposure to patients and operators, turning previously inaccessible focal lesions into potential biopsy targets.


This abstract presented at the 2013 World Conference on Interventional Oncology describes a retrospective review of 64 patients who underwent biopsy procedures performed using the OnControl system by one interventional radiology group. The authors concluded that the device was especially useful for hard bones and difficult to reach lesions, resulted in shorter procedure times with less physician effort, and that use of the device resulted in larger/higher quality specimens, a broader spectrum of potential users, and reduced radiation exposure to patients and clinicians. This study was sponsored by Vidacare Corporation.


Literature review and meta-analysis to determine if the OnControl powered biopsy retrieval system provides for significantly different/improved outcomes for patient pain and sample size. PubMed and Cochrane search done for randomized controlled trials that compared the OC method with manual methods was completed. Authors concluded this analysis demonstrates the OC powered system results in less patient pain and a greater amount of biopsy sample capture with similar adverse events. It also demonstrates the OC system is easy to use.
Hematology/Oncology Bibliography
Case Study

YEAR: 2014
This abstract describes use of the powered OnControl Bone Access System with coaxial needles to perform 12 consecutive biopsy procedures of lytic and sclerotic bone lesions. A pathologist was present to provide assessment of the initial specimens and all were of adequate volume/cellularity. One complication of asymptomatic pneumothorax was reported; a precautionary chest tube was placed. The authors concluded the powered biopsy system/co-axial needle set reliably yields multiple large biopsy specimens of adequate cellularity.

Symington K, Martinez F, Miller LJ, Philbeck T. Examination of 64 consecutive specimens obtained using a powered biopsy device. JVIR 2014;25(3s):S196
This abstract describes the initial experience of one radiology group's use of the powered OnControl system to perform biopsy of focal bone lesions and bone marrow aspiration/biopsy. The authors concluded that the powered system results in higher quality specimens, easier and faster performance of biopsy, a broader spectrum of potential users, and reduced radiation exposure to patients and operators, turning previously inaccessible focal lesions into potential biopsy targets.

YEAR: 2013
This abstract presented at the 2013 World Conference on Interventional Oncology describes a retrospective review of 64 patients who underwent biopsy procedures using the OnControl system by one interventional radiology group. The authors concluded that the device was especially useful for hard bones and difficult to reach lesions, resulted in shorter procedure times with less physician effort, and that use of the device resulted in larger/higher quality specimens, a broader spectrum of potential users, and reduced radiation exposure to patients and clinicians. This study was sponsored by Vidacare Corporation.

YEAR: 2012
Falcon MG, Assanasen C, Thomas P, Saldivar V. Comparison of a rotary powered bone marrow aspiration and biopsy device to the traditional manual device in adolescent. Blood 2012;120:Abstract 4718
A case study of bilateral bone marrow aspiration and biopsy procedures performed on a 17-year-old female with relapsed alveolar rhabdomyosarcoma. The patient’s bone marrow procedures were performed using the powered OnControl Bone Marrow Biopsy System and the manual Jamshidi needle. Results found the OnControl was superior to the manual device in terms of time to biopsy collection, time to aspirate collection, and operator satisfaction. There was no difference between the devices for number of attempts and post-procedural pain score. The manual procedure yielded a biopsy sample that was longer (9mm vs 14 mm), wider (1.5 mm vs 2mm), and of a higher quality rating (1 vs 2) than the OnControl procedure. This study was sponsored by Vidacare Corporation.

YEAR: 2007
Chamisa I. Fatal vascular retroperitoneal injury following bone marrow biopsy. SAMJ 2007;97(4):246
This article describes a case study in which a patient died as a result of abdominal compartment syndrome, secondary to extravasation following a bone marrow biopsy procedure.

This letter to the editor describes one hospital’s evaluation of patient discomfort associated with bone marrow procedures and makes a case for use of palliative care consultations in this patient population.

YEAR: 2006
Case study is presented describing a case of severe and debilitating sciatic nerve palsy secondary to gluteal artery pseudoaneurysm following a bone marrow biopsy procedure.

YEAR: 2005
Letter to the editor described a case of bone marrow embolism following bone marrow procedures.

YEAR: 2004
This case study describes endovascular approach in providing fast and minimally invasive treatment of retroperitoneal hemorrhage following bone marrow biopsy.
Case Study

This is a report of a case in which a 31-year-old woman had bone harvested from the left anterior iliac crest, and sustained a subsequent temporary femoral mononeuropathy. She later recovered completely.

This is a letter to editor which reviews typical complications associated with bone marrow procedures and presented the case of a fatality associated with a sternal bone marrow procedure.

YEAR: 2003
The author of this letter to editor presented two cases of hemorrhaging associated with bone marrow procedures.

YEAR: 1989
The objective of this study was to determine the clinicopathologic correlations and impact on survival of bone marrow and peripheral blood involvement in a series of 172 cases of NHL. Results showed that the overall incidence of blood involvement by lymphoma was 28.5%; blood involvement correlated with splenomegaly, bulky disease, advance clinical stage, and extent of bone marrow infiltration.

YEAR: 1985
In this case report, a 74 year-old man received a bone marrow biopsy for evaluation of non-Hodgkin’s lymphoma. Within approximately 1 year of the bone marrow biopsy the patient was found to have developed a 6 cm tumor at the original biopsy site as a result of suspected seeding along the needle tract.
This article describes a cadaver study comparing the perpendicular and lateral approaches for performing bone marrow biopsy procedures in the posterior iliac crest to determine if one approach is preferred. The cadavers were placed in the left and right lateral decubitus position for the procedures; the manual Jamshidi and powered needles were used. The needle pathways for each approach were evaluated under CT and the bone was dissected to evaluate structural damage. The authors found that continued advancement of the needle with the perpendicular approach was associated with an increased likelihood of injury to nearby arteries and nerves, and the sacroiliac joint with inadvertent penetration of the inner cortex. The lateral approach was found to be significantly less likely to result in neuro-vascular damage or trauma to the sacroiliac joint. The authors also note that the lateral approach yields significantly longer specimens though the data collected is limited and not specified in the article.

A prospective, randomized study conducted in Switzerland comparing the manual biopsy device to the powered OnControl device when used for bone marrow biopsy. Fifty patients were enrolled; results showed no statistical difference between the two groups for median procedure time (Manual= 180 sec; Powered=150 sec), diagnostic quality of specimen, patient reported pain (for sedated patients), patient overall satisfaction, and operator satisfaction. Subset analysis of 15 patients without sedation found statistically lower median pain scores with powered system over manual (Manual=6.3; Powered=2.9; scale 0-10, p=0.015). Authors concluded that the powered system has limited advantages over the manual system; and patients who do not wish to be sedated may be considered for use of the device.

This abstract presented at the 2013 American Society of Pediatric Hematology/Oncology Annual meeting describes a randomized study comparing bone marrow biopsy and aspiration procedures performed using the traditional manual device and the powered OnControl device in pediatric patients. The authors concluded that OnControl biopsies were obtained safely, in less time, and in good quality compared to those obtained using traditional manual devices and that the benefits may lead to reductions in anesthesia time and overall cost. This study was sponsored by Vidacare Corporation.

This retrospective study evaluated the diagnostic value of MRI guided percutaneous musculoskeletal lesions. European Journal of Radiology 2013. http://dx.doi.org/10.1016/j.ejrad.2013.09.005

This prospective study evaluated use of the OnControl Coaxial Biopsy System to perform 25 CT-guided percutaneous bone biopsy procedures. Results were compared to historical manual biopsy procedure data. Data points included specimen adequacy, procedure time, number of procedural CT examinations, radiation dose, and complications. All specimens were obtained on first attempt and deemed adequate for histological diagnosis. The mean specimen length was 2.68 ± 0.68 cm; mean procedure time was 10.5 ± 3.5 minutes which is significantly less than the mean time for manual procedures of 19.4 ± 7.5 minutes. There were no complications. The authors concluded that use of the OnControl system provided a safe, quick and effective means of sampling bone lesions with minimal patient pain.

This prospective study evaluated use of the SuperCore Biopsy Instrument to perform minimally invasive ultrasound-guided synovial biopsy procedures in 22 adult patients.

This study is a retrospective evaluation of 162 CT-guided bone lesion core needle biopsy procedures performed by two musculoskeletal radiologists using a standard coaxial technique. The objective of this study was to determine if factors could be identified that influence the diagnostic yield of these procedures. The authors concluded that diagnostic yield correlated with lesion type and size; and that lytic lesions and larger lesions produced higher diagnostic yield than sclerotic lesions and lesions <3cm.

Literature review and meta-analysis to determine if the OnControl powered biopsy retrieval system provides for significantly different/improved outcomes for patient pain and sample size. PubMed and Cochrane search done for randomized controlled trials that compared the OC method with manual methods was completed. Authors concluded this analysis demonstrates the OC powered system results in less patient pain and a greater amount of biopsy sample capture with similar adverse events. It also demonstrates the OC system is easy to use.

YEAR: 2012


This abstract describes a retrospective analysis of one institution’s initial experience with the OnControl system when used for musculoskeletal bone tumors. CT guided biopsies were performed and compared between the OnControl system, Avamax bone biopsy needle, AprioMed BoneOpty bone biopsy needle, and the Kyphon Kyphx Express bone biopsy device. Thirty-five procedures were performed using OnControl. Results showed CT guided bone biopsies performed with OnControl resulted in significantly less time to complete the procedure compared to manual bone drill devices, without a decrease in quality. No significant difference was reported between devices in radiation dose during CT guided procedure, administered anesthetic medication, or procedure related complications. The author concludes that use of the OnControl system led to improved patient care, and cost effectiveness, resulting in significant reduction in procedure time while maintaining similar safety and diagnostic quality of the specimens.


An observational study evaluating patient state of anxiety prior to a bone marrow sampling procedure and evaluating if anxiety affects the patient reported procedural pain. Results showed that pre-procedural anxiety had a major impact on pain rating; first-timers and repeat biopsy patients had similar degree of pre-procedural anxiety, as well as intensity of procedural pain; infiltration of local anesthetic was less painful with the first timers.


A clinical study evaluating the differences in the perception of pain and anxiety during bone marrow aspiration and biopsy procedures between the health-care professionals and the patients. Results indicated that both RNs and physicians underestimated the severe pain and anxiety for needle insertion reported by patients. Procedures were performed using the standard manual device.

YEAR: 2011


This abstract describes a clinical evaluation of the Vidacare Bone Access System, used to access the vertebral body for delivery of bone cement during vertebroplasty procedures. Clinicians used the device to perform 43 vertebroplasty procedures on 40 patients. All procedures were successful and there were no complications. Conduct of this trial was sponsored by Vidacare Corporation.

Berenson JR, Yellin O, Blumenstein B, Bojanower D, Croopnick J, Aboulafia D, et al. Using a powered bone marrow biopsy system results in shorter procedures, causes less residual pain to adult patients, and yields larger specimens. Diagnostic Pathology 2011;6:23

This article outlines the 102 patient, multi-center, randomized, controlled trial comparing the powered OnControl system to the standard manual technique in community-based cancer clinics. Thirteen device operators from 10 sites participated. Procedure time was significantly less for the powered device (102.1 ± 86.4 seconds) compared to the manual device (203.1 ± 149.5 seconds; p<0.001). One day following the procedure more patients were pain-free from the powered group (67%) than the manual group (33%); sample volume was larger for the powered group (36.8 mm3 ± 21.2) than the manual group (20.4 mm3 ± 9.0; p=0.039). Conduct of this trial was sponsored by Vidacare Corporation.

Berenson JR, Yellin O, Blumenstein B, Philbeck T. Rotary-powered bone marrow access results in shorter procedure time, larger core specimens and less residual pain for patients. J Vasc and Interv Radiol 2011;22(3):S15

This abstract describes the 102 patient, multi-center, trial comparing the powered OnControl system to the standard manual technique. Results showed procedure time was significantly less, more patients were pain free one day following the procedure, and sample volume was larger for the powered group. This trial was sponsored by Vidacare Corporation.

Abstract (Oral Presentation at 2011 SIR)
Cherington C, Robetorye R, Anderson EM et al. High quality bone marrow core biopsy and aspiration (BMBX) procedures can be performed by a nurse led team using the OnControl battery powered bone marrow biopsy system. Blood (ASH Annual Meeting Abstracts) 2011;118: Abstract 4743

In this clinical study, a nurse-led bone marrow biopsy team evaluated the OnControl system for patient care and safety, team satisfaction and specimen quality. Ninety-four (94) bone marrow biopsy procedures were performed and specimen quality was compared to 25 manual specimens obtained by the same team. Results showed the majority of nurses felt in control of depth, were satisfied with ease of aspirate collection, felt improved ergonomics, and preferred OnControl over the manual if given a chance. All but 2 samples collected with OnControl were adequate for evaluation. The authors concluded that in the hands of experienced individuals, OnControl can consistently yield high-quality bone marrow biopsy specimens.


In this study healthy volunteers were used to comparatively evaluate the powered OnControl system and the standard manual biopsy device. Each subject had a procedures performed with both devices, the order performed was randomized. Results showed samples were obtained in 66.7% of manual procedures and 100% of powered procedures (only single attempts were permitted). Mean time to sample was 86 seconds for the manual group and 47 seconds for the powered; mean second look pain score using 100mm VAS (where higher number indicate greater pain) was 33.3 for the manual and 20.9 for the powered. Pathology evaluation showed a mean sample volume of 11.0 ± 10.8 mm³ for the manual and 49.1 ± 21.5 mm³ for the powered. This study was sponsored by Vidacare Corporation.


This article describes a 54 patient randomized controlled trial conducted at 2 academic centers comparing the OnControl powered bone marrow system and the standard manual device in a teaching hospital employing hematologists-in-training. The primary endpoint of the study, the mean length of the marrow biopsy specimens, a surrogate for marrow quality, was determined by a pathologist in a blinded manner. It was concluded that bone marrow procedures performed by hematologists-in-training were significantly faster and superior in quality when performed with the powered device compared to manual devices. These data suggest that the powered device may be considered a new standard of care for adult hematology patients. The powered device also appears to be a superior method for training hematology fellows. This study was sponsored by Vidacare Corporation.

Reed, LJ, Raghupathy R, Strakhan, M et al. The powered bone marrow biopsy technique is superior to the standard manual technique for hematologists-in-training: a prospective, randomized comparison. American Society of Hematology (ASH) December 2011; abstract 3133

This abstract describes a 54 patient randomized controlled trial conducted at 2 academic centers comparing the OnControl powered bone marrow system and the standard manual device in a teaching hospital employing hematologists-in-training. The primary endpoint of the study, the mean length of the marrow biopsy specimens, a surrogate for marrow quality, was determined by a pathologist in a blinded manner. It was concluded that bone marrow procedures performed by hematologists-in-training were significantly faster and superior in quality when performed with the powered device compared to manual devices. These data suggest that the powered device may be considered a new standard of care for adult hematology patients. The powered device also appears to be a superior method for training hematology fellows. This study was sponsored by Vidacare Corporation.


Two large academic centers participated in this prospective randomized study comparing use of the manual bone marrow biopsy device to the powered OnControl bone marrow biopsy system for collection of bone marrow biopsy specimens in adult patients. Fifty patients were enrolled into this study, 25 were assigned to the manual group and 25 were assigned to the powered group. The powered system was superior to the manual device with respect to patient perceived pain from needle insertion and procedural time. Blinded pathological evaluation indicated that specimens collected with the powered system were longer and wider than those collected with the manual device. Authors concluded that the superior size and overall quality of the specimens retrieved using the powered system provide more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures.


A prospective study of 202 patients undergoing bone marrow biopsy and aspirating and anxiety and pain to determine if there are factors that can predict pain score. Procedures were performed using the T-Lok bone marrow biopsy needle. The median pain score was 1.9, on a 0 to 10 scale with 21% of patients experiencing no pain at all; anxiety scored 1.8 and correlated positively with pain. The following similarities were identified among patients who reported higher pain scores: young patient age, poor performance score, prolonged procedures, and patients who were informed about the procedure by the physician. Authors concluded that bone marrow biopsies performed in an optimal setting by experienced hematologists cause only mild pain.
Abstract which may help identify patients in need of complementary interventions to alleviate pain.


This abstract describes a 102-patient multicenter randomized clinical trial that was designed to determine if a new powered bone marrow sampling device has advantages over traditional manually-inserted needles in terms of decreased pain, decreased procedure time, higher biopsy core capture rate, ease of use, improved sample yield, and higher operator satisfaction scores. Results suggest use of the powered bone marrow biopsy device markedly shortens the procedure time and reduces intermediate-term pain—important considerations for the quality of life for patients undergoing this procedure.

Abstract


A randomized, controlled study conducted at Wake Forest University Comprehensive Cancer Center, evaluating the effect of music played during the bone marrow biopsy procedure on the patient pain and anxiety. Sixty-three (63) subjects were enrolled; Jamshidi was used to perform aspiration and biopsy; there was no significant difference between the music group and the group without music in terms of anxiety or pain. Subjects did however indicate that they highly liked the music and would prefer it on future procedures.


A single center, prospective survey of physicians performing and patients receiving bone marrow examination found pain to be the only procedure related complication. Results suggest that when patients had inadequate information about their procedure, they tended towards an association with unbearable pain.


This abstract describes a 24-subject/48-biopsy specimen study designed to determine if the powered bone-marrow biopsy device has advantages over traditional manual devices in terms of decreased pain, insertion time, and improved sample yield. Results suggest the superior size and overall quality of core specimens delivered by the powered device may provide more material for pathological evaluation of hematopoietic and oncological disorders. The powered device was significantly faster in obtaining a biopsy than the manual device and its capture rate in obtaining a satisfactory sample was much higher. Use of the powered device significantly decreases overall procedure pain.


This abstract describes a 50-patient study that compared the powered device to the traditional manual technique by relatively assessing pain scores, procedure time, biopsy capture rates, quality of material retrieved, safety and operator satisfaction. Results suggest that the use of a powered bone marrow biopsy device significantly reduces needle insertion pain. Moreover, the superior size and overall quality of core specimens retrieved by the powered device provides more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures. This study was sponsored by Vidacare Corporation.


This article summarizes a preclinical study designed to determine cellular artifact or thermal damage resulting from powered bone marrow sampling and a clinical evaluation of the powered bone marrow sampling device. No cellular artifact or thermal damage was found and the device was found to be safe and easy to use, with significantly shorter procedure time than when using a manual technique.

YEAR: 2009


Prospective study of cancer patients evaluating the characteristics and determinants of procedure-related pain, with bone marrow aspiration/biopsy (BMA) as the procedure. 70% of patients reported moderate to severe pain. Predictors of pain during BMA were identified which may help identify patients in need of complementary interventions to alleviate pain.
Hematology/Oncology Bibliography
Clinical, Observational and Other Studies

A double-blind, randomized crossover study in which 48 patients received bilateral bone marrow biopsy procedures, one side with buffered lidocaine and one side with unbuffered lidocaine. Results showed that using 100 mm VAS (visual analog scale) pain scale, patients reported significantly lower pain scores on the buffered lidocaine side than the unbuffered lidocaine side.

This abstract summarizes a preclinical study designed to determine cellular artifact or thermal damage resulting from powered bone marrow sampling and a clinical evaluation of the powered bone marrow sampling device. No cellular artifact or thermal damage was found and the device was found to be safe and easy to use, with significantly shorter procedure time than when using a manual technique.

YEAR: 2008

This article discusses use of the OnControl Aspiration system in 55 patients. Successful aspirate collected in 54 of 55 patients; mean insertion time was 4.9 seconds; mean insertion pain score was 2.5. This study was sponsored by Vidacare Corporation.

This abstract describes an observational study designed to evaluate the ability of a new powered bone marrow aspiration device to obtain bone marrow samples. Mean needle insertion time was significantly lower than previously reported. Findings suggested the device is safe and effective.

This study evaluated the efficacy of IV lorazepam, 1mg, as premedication for bone marrow aspiration and biopsy procedures. 138 patients were enrolled, all received local 1% lidocaine and either lorazepam or placebo just before the procedure. Outcome measures included a questionnaire to determine patient perception of the procedure and pain assessments at baseline, just following the procedure, and the next day using a 10cm VAS. Results: IV lorazepam, 1mg, provides no reduction in pain associated with bone marrow aspiration biopsy procedures; more patients receiving the lorazepam reported they were more likely to agree to a second bone marrow procedure.

The objective of this study was to evaluate percutaneous core needle biopsy in the diagnosis of musculoskeletal sarcomas. One hundred seventy-three biopsy procedures were performed; in 88.2% of cases, a single percutaneous biopsy was adequate. Additionally, patients undergoing percutaneous biopsy rather than open biopsy had lower rates of major diagnostic errors and complications. The authors concluded that percutaneous needle biopsy was found to be extremely effective and safe for the diagnosis of musculoskeletal masses.

YEAR: 2007

This article describes a 68 patient study in which patients underwent bone biopsy using a Black and Decker drill to access the iliac crest. Investigators successfully obtained diagnostic material in 80% of the cases with no major complications.

This abstract describes an observational study designed to evaluate the ability of a new powered bone marrow aspiration device to obtain bone marrow samples. Mean needle insertion time was significantly lower than previously reported. Findings suggested the device is safe and effective.

Islam A. Bone marrow aspiration before bone marrow core biopsy using the same bone marrow biopsy needle: a good or bad practice?. J Clin Pathol 2007;60:212-5
This article describes a clinical study of bone marrow aspiration and core biopsy procedures in which single-needle/single-site technique was compared to a double-needle technique. Investigators found the double-needle technique to be superior.
YEAR: 2005


This retrospective study evaluated the adequacy of bone marrow aspirate and biopsy samples collected over the course of one year. Of 69 aspirations and 61 biopsies, 42% of aspirations and 32% of biopsies were found to be inadequate. The authors conclude that aspirate and biopsy samples are complementary and give a higher diagnostic yield when both are available for a patient.

YEAR: 2004


This article describes retrospective study to establish safety of deep sedation used for adults undergoing bone marrow biopsy and aspiration. Results suggest that deep sedation for outpatient bone marrow biopsy and aspiration is as safe as using local anesthetics.


This article describes a 263 patient study in which patients receiving bone marrow procedures were evaluated for pain. Substantial pain was reported by 30.4% of patients, but physicians did not realize the pain was felt in more than 50% of the cases. Duration of the procedure was identified as the sole independent predictive factor for patients’ pain intensity.

YEAR: 2003


This article describes an observational study of 132 patients undergoing bone marrow aspiration procedures. Investigators concluded that the great majority of patients experience transient pain during the procedure.

YEAR: 2002


The objective of this study was to evaluate the efficacy of bone marrow aspiration as compared to bone marrow biopsy for the purpose of disease diagnosis. Of 420 consecutive cases, aspiration alone was sufficient in making a diagnosis in 372 (88.6%). In the remaining cases bilateral biopsy was required to reach a diagnosis.

YEAR: 2001


This article describes an observational study in which the SNARECOIL™ needle was used for 44 patients requiring bone marrow biopsies. Of 50 procedures, 52% of the specimens were ≥2.0cm in length.

YEAR: 1999


This article describes a follow up study to a prior study conducted by the same group of investigators (Reid 1996) evaluating the adequacy of bone marrow biopsy specimens obtained from children. Specimens obtained from 25 different centers were evaluated by a central pathologist and graded for adequacy. Of 605 specimens collected from 150 children with neuroblastoma, 154 specimens (25%) were deemed inadequate. The authors concluded that local initiatives involving active and direct feedback from reporting pathologists should be employed to influence operators.

YEAR: 1997


This article describes a 10 year study of 4,902 patients receiving bone marrow procedures to assess the value of specific components. Investigators concluded that bilateral aspirates with biopsies are needed for diagnosis in staging for neoplasms, and that a unilateral aspirate with biopsy is sufficient to assess patients with cytopenia and leukemia.
YEAR: 1993

Ahlstrom KH, Astrom KGO. CT-guided bone biopsy performed by means of a coaxial biopsy system with an eccentric drill. Radiology 1993;188:549-52
The authors describe a 32 patient study in which a makeshift bone biopsy system, that included a power drill, was used to obtain the bone marrow sample. Successful samples were obtained in 43% of the 37 cases.

YEAR: 1988

This article describes a study involving 256 bone marrow biopsy procedures, in which biopsy specimens were compared with peripheral blood smears and bone marrow aspirates. Researchers concluded that when blood and aspirate samples fail to indicate the diagnosis, a long-core biopsy may provide positive results.

YEAR: 1983

This study compared bone biopsy samples taken using a 3mm diameter Jamshidi needle and 5mm diameter electric drill for qualitative and quantitative study of bone histology. Statistical evaluation of the differences and correlations between histomorphometric parameters was performed; results showed that 3mm diameter samples were sufficient for qualitative diagnosis but were not optimum for the quantitative evaluation of cellular parameters of resorption and formation.

YEAR: 1982

This article describes a study involving 129 bone marrow biopsy procedures using Schaadt-Fischer needles and technique. Authors concluded that using the technique makes it possible to obtain adequate biopsies in 80 to 90% of all patients.

YEAR: 1964

The authors describe early study of 1,445 bone marrow biopsy procedures using a modification of the Silverman needle.

YEAR: 1959

Brody JI, Finch SC. Bone marrow needle biopsy. The American Journal of Medical Sciences 1959:140-5
This article describes early 100-patient study of bone marrow procedures. Procedure and technique is described in great detail. With focus on patients undergoing biopsies, investigators concluded that the method is simple, safe and convenient for patients; and that the method will replace surgical procedures for obtaining bone marrow biopsies.

This abstract describes use of the powered OnControl Bone Access System with coaxial needles to perform 12 consecutive biopsy procedures of lytic and sclerotic bone lesions. A pathologist was present to provide assessment of the initial specimens and all were of adequate volume/cellularity. One complication of asymptomatic pneumothorax was reported; a precautionary chest tube was placed. The authors concluded the powered biopsy system/co-axial needle set reliably yields multiple large biopsy specimens of adequate cellularity.


Literature review and meta-analysis to determine if the OnControl powered biopsy retrieval system provides for significantly different/improved outcomes for patient pain and sample size. PubMed and Cochrane search done for randomized controlled trials that compared the OC method with manual methods was completed. Authors concluded this analysis demonstrates the OC powered system results in less patient pain and a greater amount of biopsy sample capture with similar adverse events. It also demonstrates the OC system is easy to use.

Berenson JR, Yellin O, Blumenstein B, Bojanower D, Croopnick J, Aboulafia D, et al. Using a powered bone marrow biopsy system results in shorter procedures, causes less residual pain to adult patients, and yields larger specimens. Diagnostic Pathology 2011;6:23

This article outlines the 102 patient, multi-center, randomized, controlled trial comparing the powered OnControl system to the standard manual technique in community-based cancer clinics. Thirteen device operators from 10 sites participated. Procedure time was significantly less for the powered device (102.1 ± 86.4 seconds) compared to the manual device (203.1 ± 149.5 seconds; p<0.001). One day following the procedure more patients were pain-free from the powered group (67%) than the manual group (33%); sample volume was larger for the powered group (36.8 mm³ ± 21.2) than the manual group (20.4 mm³ ± 9.0; p=0.039). Conduct of this trial was sponsored by Vidacare Corporation.

Berenson JR, Yellin O, Blumenstein B, Philbeck T. Rotary-powered bone marrow access results in shorter procedure time, larger core specimens and less residual pain for patients. J Vasc and Interv Radiol 2011;22(3):S15

This abstract describes the 102 patient, multi-center, trial comparing the powered OnControl system to the standard manual technique. Results showed procedure time was significantly less, more patients were pain free one day following the procedure, and sample volume was larger for the powered group. This trial was sponsored by Vidacare Corporation.


This abstract describes a 102-patient multicenter randomized clinical trial that was designed to determine if a new powered bone marrow sampling device has advantages over traditional manually-inserted needles in terms of decreased pain, decreased procedure time, higher biopsy core capture rate, ease of use, improved sample yield, and higher operator satisfaction scores. Results suggest use of the powered bone marrow biopsy device markedly shortens the procedure time and reduces intermediate-term pain—important considerations for the quality of life for patients undergoing this procedure.


This abstract summarizes a preclinical study designed to determine cellular artifact or thermal damage resulting from powered bone marrow sampling and a clinical evaluation of the powered bone marrow sampling device. No cellular artifact or thermal damage was found and the device was found to be safe and easy to use, with significantly shorter procedure time than when using a manual technique.


This article provides a general overview of the process of iliac crest bone biopsy including the indications, preparation, instrumentation, and potential complications, with a focus on use of the procedure for diagnosis and treatment of renal osteodystrophy.
Hematology/Oncology Bibliography

Complications

YEAR: 2007
Chamisa I.  Fatal vascular retroperitoneal injury following bone marrow biopsy.  SAMJ 2007;97(4):246
This article describes a case study in which a patient died as a result of abdominal compartment syndrome, secondary to extravasation following a bone marrow biopsy procedure.

YEAR: 2006
Case study is presented describing a case of severe and debilitating sciatic nerve palsy secondary to gluteal artery pseudoaneurysm following a bone marrow biopsy procedure.

YEAR: 2005
This article summarizes the occurrence of adverse events associated with diagnostic bone marrow aspirates and trephine biopsies between January 1- December 31, 2003, as reported by members of the British Society of Haematology. Of 19,259 bone marrow procedures performed as reported by 63 hospitals, 16 adverse events were reported (0.08%) with 11 of them being hemorrhage.

Letter to the editor described a case of bone marrow embolism following bone marrow procedures.

YEAR: 2004
This case study describes endovascular approach in providing fast and minimally invasive treatment of retroperitoneal hemorrhage following bone marrow biopsy.

This is a report of a case in which a 31-year-old woman had bone harvested from the left anterior iliac crest, and sustained a subsequent temporary femoral mononeuropathy. She later recovered completely.

This is a letter to editor which reviews typical complications associated with bone marrow procedures and presented the case of a fatality associated with a sternal bone marrow procedure.

This article provides an overview of performing bone marrow aspirate and biopsy examination from indications for bone marrow examination through post procedure care, including possible complications.

YEAR: 2003
Bain BJ.  Bone marrow biopsy morbidity and mortality.  British Journal of Haematology 2003;121:949-51
The author describes a postal survey of British hematologists to determine adverse event rates during bone marrow procedures. Of nearly 55,000 procedures, only 26 adverse events were reported, including one death. The most frequent and serious adverse event was hemorrhage, reported in 14 cases.

The author of this letter to the editor opined that therapy with low molecular weight heparin should be considered an absolute contraindication to bone marrow biopsy.

The author of this letter to editor presented two cases of hemorrhaging associated with bone marrow procedures.

YEAR: 2001
van Iperen CE, Cornelissen JJ.  Bone marrow aspiration, a dangerous procedure?.  The Netherlands Journal of Medicine 2001;59:4-5
In this editorial, authors briefly review precautions that should be taken to perform safe bone marrow procedures.

In this case report, a 74 year-old man received a bone marrow biopsy for evaluation of non-Hodgkin’s lymphoma. Within approximately 1 year of the bone marrow biopsy the patient was found to have developed a 6 cm tumor at the original biopsy site as a result of suspected seeding along the needle tract.
**Hematology/Oncology Bibliography**

**Devices**

**YEAR: 2014**


This article describes a cadaver study comparing the perpendicular and lateral approaches for performing bone marrow biopsy procedures in the posterior iliac crest to determine if one approach is preferred. The cadavers were placed in the left and right lateral decubitus position for the procedures; the manual Jamshidi and powered needles were used. The needle pathways for each approach were evaluated under CT and the bone was dissected to evaluate structural damage. The authors found that continued advancement of the needle with the perpendicular approach was associated with an increased likelihood of injury to nearby arteries and nerves, and the sacroiliac joint with inadvertent penetration of the inner cortex. The lateral approach was found to be significantly less likely to result in neuro-vascular damage or trauma to the sacroiliac joint. The authors also note that the lateral approach yields significantly longer specimens though the data collected is limited and not specified in the article.

**YEAR: 2013**


A prospective, randomized study conducted in Switzerland comparing the manual biopsy device to the powered OnControl device when used for bone marrow biopsy. Fifty patients were enrolled; results showed no statistical difference between the two groups for median procedure time (Manual= 180 sec; Powered=150 sec), diagnostic quality of specimen, patient reported pain (for sedated patients), patient overall satisfaction, and operator satisfaction. Subset analysis of 15 patients without sedation found statistically lower median pain scores with powered system over manual (Manual=6.3; Powered=2.9; scale 0-10, p=0.015). Authors concluded that the powered system has limited advantages over the manual system; and patients who do not wish to be sedated may be considered for use of the device.


This abstract presented at the 2013 American Society of Pediatric Hematology/Oncology Annual meeting describes a randomized study comparing bone marrow biopsy and aspiration procedures performed using the traditional manual device and the powered OnControl device in pediatric patients. The authors concluded that OnControl biopsies were obtained safely, in less time, and in good quality compared to those obtained using traditional manual devices and that the benefits may lead to reductions in anesthesia time and overall cost. This study was sponsored by Vidacare Corporation.


This retrospective study evaluated the diagnostic value of MRI guided percutaneous musculoskeletal biopsy and the value of fine needle aspiration biopsy when combined with histologic biopsy in 172 procedures. The authors concluded that MRI guidance produced greater diagnostic accuracy than trepine biopsy and fine needle aspiration biopsy when each are used alone.


A prospective study that evaluated use of the SuperCore Biopsy Instrument to perform minimally invasive ultrasound-guided synovial biopsy procedures in 22 adult patients.


This study is a retrospective evaluation of 162 CT-guided bone lesion core needle biopsy procedures performed by two musculoskeletal radiologists using a standard coaxial technique. The objective of this study was to determine if factors could be identified that influence the diagnostic yield of these procedures. The authors concluded that diagnostic yield correlated with lesion type and size; and that lytic lesions and larger lesions produced higher diagnostic yield than sclerotic lesions and lesions < 3cm.

**YEAR: 2012**


A pre-clinical study that compared the EZ-IO 15 gauge 25mm needle set and the 13 gauge Jamshidi aspiration/biopsy needle when used to obtain core biopsy specimens in canines.
Falcon MG, Assanasen C, Thomas P, Saldivar V. Comparison of a rotary powered bone marrow aspiration and biopsy device to the traditional manual device in adolescent. Blood 2012;120:Abstract 4718

A case study of bilateral bone marrow aspiration and biopsy procedures performed on a 17-year-old female with relapsed alveolar rhabdomyosarcoma. The patient's bone marrow procedures were performed using the powered OnControl Bone Marrow Biopsy System and the manual Jamshidi needle. Results found the OnControl was superior to the manual device in terms of time to biopsy collection, time to aspirate collection, and operator satisfaction. There was no difference between the devices for number of attempts and post-procedural pain score. The manual procedure yielded a biopsy sample that was longer (9mm vs 14 mm), wider (1.5 mm vs 2mm), and of a higher quality rating (1 vs 2) than the OnControl procedure. This study was sponsored by Vidacare Corporation.


This article discusses the new medical devices, including bone marrow aspiration and biopsy capture devices, shown at the ASH 2012 meeting.


This abstract describes a retrospective analysis of one institution's initial experience with the OnControl system when used for musculoskeletal bone tumors. CT guided biopsies were performed and compared between the OnControl system, Avamax bone biopsy needle, AprioMed BoneOpty bone biopsy needle, and the Kyphon Kyphx Express bone biopsy device. Thirty-five procedures were performed using OnControl. Results showed CT guided bone biopsies performed with OnControl resulted in significantly less time to complete the procedure compared to manual bone drill devices, without a decrease in quality. No significant difference was reported between devices in radiation dose during CT guided procedure, administered anesthetic medication, or procedure related complications. The author concludes that use of the OnControl system led to improved patient care, and cost effectiveness, resulting in significant reduction in procedure time while maintaining similar safety and diagnostic quality of the specimens.


This abstract describes a clinical evaluation of the Vidacare Bone Access System, used to access the vertebral body for delivery of bone cement during vertebroplasty procedures. Clinicians used the device to perform 43 vertebroplasty procedures on 40 patients. All procedures were successful and there were no complications. Conduct of this trial was sponsored by Vidacare Corporation.

Berenson JR, Yellin O, Blumenstein B, Bojanower D, Croopnick J, Aboulafia D, et al. Using a powered bone marrow biopsy system results in shorter procedures, causes less residual pain to adult patients, and yields larger specimens. Diagnostic Pathology 2011;6:23

This article outlines the 102 patient, multi-center, randomized, controlled trial comparing the powered OnControl system to the standard manual technique in community-based cancer clinics. Thirteen device operators from 10 sites participated. Procedure time was significantly less for the powered device (102.1 ± 86.4 seconds) compared to the manual device (203.1 ± 149.5 seconds; p<0.001). One day following the procedure more patients were pain-free from the powered group (67%) than the manual group (33%); sample volume was larger for the powered group (36.8 mm3 ± 21.2) than the manual group (20.4 mm3 ± 9.0; p=0.039). Conduct of this trial was sponsored by Vidacare Corporation.

Berenson JR, Yellin O, Blumenstein B, Philbeck T. Rotary-powered bone marrow access results in shorter procedure time, larger core specimens and less residual pain for patients. J Vasc and Interv Radiol 2011;22(3):S15

This abstract describes the 102 patient, multi-center, trial comparing the powered OnControl system to the standard manual technique. Results showed procedure time was significantly less, more patients were pain free one day following the procedure, and sample volume was larger for the powered group. This trial was sponsored by Vidacare Corporation.


This study evaluated the ability of the clinician to successfully insert manual driven needles, hammer driven needles, and power driven needles into simulated bone material of varying depths, to the requested depth. Placement was confirmed by fluoroscopy. Results showed insertion success with manual was 48.5%, with hammer was 69.7% and, with powered was 91%; statistically significant (p<.05). This study was sponsored by Vidacare Corporation.

YEAR: 2011

This study healthy volunteers were used to comparatively evaluate the powered OnControl system and the standard manual biopsy device. Each subject had a procedures performed with both devices, the order performed was randomized. Results showed samples were obtained in 66.7% of manual procedures and 100% of powered procedures (only single attempts were permitted). Mean time to sample was 86 seconds for the manual group and 47 seconds for the powered; mean second look pain score using 100mm VAS (where higher number indicate greater pain) was 33.3 for the manual and 20.9 for the powered. Pathology evaluation showed a mean sample volume of 11.0 ± 10.8mm³ for the manual and 49.1 ± 21.5 mm³ for the powered. This study was sponsored by Vidacare Corporation.


This article describes a 54 patient randomized controlled trial conducted at 2 academic centers comparing the OnControl powered bone marrow system and the standard manual device in a teaching hospital employing hematologists-in-training. The primary endpoint of the study, the mean length of the marrow biopsy specimens, a surrogate for marrow quality, was determined by a pathologist in a blinded manner. It was concluded that bone marrow procedures performed by hematologists-in-training were significantly faster and superior in quality when performed with the powered device compared to manual devices. These data suggest that the powered device may be considered a new standard of care for adult hematology patients. The powered device also appears to be a superior method for training hematology fellows. This study was sponsored by Vidacare Corporation.


Two large academic centers participated in this prospective randomized study comparing use of the manual bone marrow biopsy device to the powered OnControl bone marrow biopsy system for collection of bone marrow biopsy specimens in adult patients. Fifty patients were enrolled into this study, 25 were assigned to the manual group and 25 were assigned to the powered group. The powered system was superior to the manual device with respect to patient perceived pain from needle insertion and procedural time. Blinded pathological evaluation indicated that specimens collected with the powered system were longer and wider than those collected with the manual device. Authors concluded that the superior size and overall quality of the specimens retrieved using the powered system provide more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures.


A prospective study of 202 patients undergoing bone marrow biopsy and aspiration evaluating anxiety and pain to determine if there are factors that can predict pain score. Procedures were performed using the T-Lok bone marrow biopsy needle. The median pain score was 1.9, on a 0 to 10 scale with 21% of patients experiencing no pain at all; anxiety scored 1.8 and correlated positively with pain. The following similarities were identified among patients who reported higher pain scores: young patient age, poor performance score, prolonged procedures, and patients who were informed about the procedure by the physician. Authors concluded that bone marrow biopsies performed in an optimal setting by experienced hematologists cause only mild pain.

**YEAR: 2010**


This article sought to assess sample volume and quality in CT-guided vertebral biopsy as it relates to lesion location and needle trajectory. Vertebral biopsy was performed on 48 patients requiring biopsy of various vertebral bodies. The median sample length was 10 mm; the mean sample width was 2 mm. The authors conclude that a transpedicular trajectory for biopsy had advantages over the posterolateral method as it provided longer samples.
This abstract describes a 102-patient multicenter randomized clinical trial that was designed to determine if a new powered bone marrow sampling device has advantages over traditional manually-inserted needles in terms of decreased pain, decreased procedure time, higher biopsy core capture rate, ease of use, improved sample yield, and higher operator satisfaction scores. Results suggest use of the powered bone marrow biopsy device markedly shortens the procedure time and reduces intermediate-term pain—important considerations for the quality of life for patients undergoing this procedure.

This abstract describes a 24-subject/48-biopsy specimen study designed to determine if the powered bone-marrow biopsy device has advantages over traditional manual devices in terms of decreased pain, insertion time, and improved sample yield. Results suggest the superior size and overall quality of core specimens delivered by the powered device may provide more material for pathological evaluation of hematopoietic and oncological disorders. The powered device was significantly faster in obtaining a biopsy than the manual device and its capture rate in obtaining a satisfactory sample was much higher. Use of the powered device significantly decreases overall procedure pain.

This abstract describes a 50-patient study that compared the powered device to the traditional manual technique by relatively assessing pain scores, procedure times, biopsy capture rates, quality of material retrieved, safety and operator satisfaction. Results suggest that the use of a powered bone marrow biopsy device significantly reduces needle insertion pain. Moreover, the superior size and overall quality of core specimens retrieved by the powered device provides more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures. This study was sponsored by Vidacare Corporation.

Symington K, Martinez Jr F. Bone marrow procedures move into the 21st century. Oncology NEWS International 2010;19(9)
Brief history of bone marrow procedures and how the IO approach is revolutionizing the field. Discusses use of OnControl. Conduct of this trial was sponsored by Vidacare Corporation.

YEAR: 2009

This article summarizes a preclinical study designed to determine cellular artifact or thermal damage resulting from powered bone marrow sampling and a clinical evaluation of the powered bone marrow sampling device. No cellular artifact or thermal damage was found and the device was found to be safe and easy to use, with significantly shorter procedure time than when using a manual technique.

YEAR: 2008

This article discusses use of the OnControl Aspiration system in 55 patients. Successful aspirate collected in 54 of 55 patients; mean insertion time was 4.9 seconds; mean insertion pain score was 2.5. This study was sponsored by Vidacare Corporation.
This abstract describes an observational study designed to evaluate the ability of a new powered bone marrow aspiration device to obtain bone marrow samples. Mean needle insertion time was significantly lower than previously reported. Findings suggested the device is safe and effective.

**YEAR: 2007**

This article describes a 68 patient study in which patients underwent bone biopsy using a Black and Decker drill to access the iliac crest. Investigators successfully obtained diagnostic material in 80% of the cases with no major complications.

This abstract describes an observational study designed to evaluate the ability of a new powered bone marrow aspiration device to obtain bone marrow samples. Mean needle insertion time was significantly lower than previously reported. Findings suggested the device is safe and effective.

Parapia LA. Trepanning or trephines: a history of bone marrow biopsy. *British Journal of Haematology* 2007;139:14-9
This article provides overview of history of bone marrow biopsy procedures; includes descriptions and illustrations of antique and modern biopsy devices.

This article describes the preliminary use of a CT-biopsy guidance device for use in musculoskeletal applications. The authors concluded that use of the device is potentially useful for musculoskeletal applications and that the linear metal artifact produced by the device can help the device operator plan the approach for biopsy.

**YEAR: 2005**

This article describes study in which investigators assessed the differences in ease of use and quality of samples among several bone biopsy needles, including models by Coo Elson/Ackerman, RADI, Bard, MD Tech, Parallax, and Kendall. The investigators concluded that biopsy needles vary significantly in performance; and that detailed knowledge of the strengths and weaknesses of different needles is important to make an appropriate selection.

**YEAR: 2001**

This article describes an observational study in which the SNARECOIL™ needle was used for 44 patients requiring bone marrow biopsies. Of 50 procedures, 52% of the specimens were ≥2.0cm in length.

**YEAR: 2000**

This study evaluated use of ultrasound guided Trucut needle biopsy in 63 patients with suspected primary bone tumors. Results showed the diagnostic accuracy of US guided biopsy was 98.4% as compared to surgical biopsy. The authors concluded that on a selected group of patients, ultrasound is a reliable technique of guidance for percutaneous needle biopsy of bone tumors.
This abstract describes the use of a tissue biopsy needle with an internal snare-coil for capturing specimen in a resin-based foam. The author concludes that further studies in patients are required to determine the impact of the snare-coil on biopsy capture.

Evaluation of 822 biopsy specimens for adequacy, collected from children with neuroblastoma over five years, from 25 centers. Found that 17% of biopsy specimens collected were inadequate.

Ahlstrom KH, Astrom KGO. CT-guided bone biopsy performed by means of a coaxial biopsy system with an eccentric drill. Radiology 1993;188:549-52
The authors describe a 32 patient study in which a makeshift bone biopsy system, that included a power drill, was used to obtain the bone marrow sample. Successful samples were obtained in 43% of the 37 cases.

This study compared bone biopsy samples taken using a 3mm diameter Jamshidi needle and 5mm diameter electric drill for qualitative and quantitative study of bone histology. Statistical evaluation of the differences and correlations between histomorphometric parameters was performed; results showed that 3mm diameter samples were sufficient for qualitative diagnosis but were not optimum for the quantitative evaluation of cellular parameters of resorption and formation.

This article describes a study involving 129 bone marrow biopsy procedures using Schaadt-Fischer needles and technique. Authors concluded that using the technique makes it possible to obtain adequate biopsies in 80 to 90% of all patients.

The author describes a bone marrow biopsy needle he designed, and the technique for using the needle.

This article (Part 1 of 2) describes bone marrow procedures in general, including techniques, preparation for slides, devices (Jamshidi-Swain), risks, and aftercare.

This article (Part 2 of 2) describes bone marrow procedures in general, including techniques, preparation for slides, devices (Jamshidi-Swain), risks, and aftercare.

The authors describe their new biopsy device.
This article describes the first clinical use of the Jamshidi biopsy needle, newly developed at the time of this article.

YEAR: 1964

The authors describe early study of 1,445 bone marrow biopsy procedures using a modification of the Silverman needle.
**YEAR: 2006**


This article describes a technique for obtaining adult stem cells from bone marrow aspirate.

**YEAR: 2004**


This article describes a 263 patient study in which patients receiving bone marrow procedures were evaluated for pain. Substantial pain was reported by 30.4% of patients, but physicians did not realize the pain was felt in more than 50% of the cases. Duration of the procedure was identified as the sole independent predictive factor for patients' pain intensity.

**YEAR: 1983**


This study compared bone biopsy samples taken using a 3mm diameter Jamshidi needle and 5mm diameter electric drill for qualitative and quantitative study of bone histology. Statistical evaluation of the differences and correlations between histomorphometric parameters was performed; results showed that 3mm diameter samples were sufficient for qualitative diagnosis but were not optimum for the quantitative evaluation of cellular parameters of resorption and formation.
This is a sample text from a scientific document. It includes various studies and research findings related to bone marrow aspiration and biopsy procedures.

For example:

**YEAR: 2011**


A prospective study of 202 patients undergoing bone marrow biopsy and aspiration evaluating anxiety and pain to determine if there are factors that can predict pain score. Procedures were performed using the T-Lok bone marrow biopsy needle. The median pain score was 1.9, on a 0 to 10 scale with 21% of patients experiencing no pain at all; anxiety scored 1.8 and correlated positively with pain. The following similarities were identified among patients who reported higher pain scores: young patient age, poor performance score, prolonged procedures, and patients who were informed about the procedure by the physician. Authors concluded that bone marrow biopsies performed in an optimal setting by experienced hematologists cause only mild pain.

**YEAR: 2009**


Prospective study of cancer patients evaluating the characteristics and determinants of procedure-related pain, with bone marrow aspiration/biopsy (BMA) as the procedure. 70% of patients reported moderate to severe pain. Predictors of pain during BMA were identified which may help identify patients in need of complementary interventions to alleviate pain.

**YEAR: 1999**


This article describes a follow up study to a prior study conducted by the same group of investigators (Reid 1996) evaluating the adequacy of bone marrow biopsy specimens obtained from children. Specimens obtained from 25 different centers were evaluated by a central pathologist and graded for adequacy. Of 605 specimens collected from 150 children with neuroblastoma, 154 specimens (25%) were deemed inadequate. The authors concluded that local initiatives involving active and direct feedback from reporting pathologists should be employed to influence operators.
This article describes a cadaver study comparing the perpendicular and lateral approaches for performing bone marrow biopsy procedures in the posterior iliac crest to determine if one approach is preferred. The cadavers were placed in the left and right lateral decubitus position for the procedures; the manual Jamshidi and powered needles were used. The needle pathways for each approach were evaluated under CT and the bone was dissected to evaluate structural damage. The authors found that continued advancement of the needle with the perpendicular approach was associated with an increased likelihood of injury to nearby arteries and nerves, and the sacroiliac joint with inadvertent penetration of the inner cortex. The lateral approach was found to be significantly less likely to result in neuro-vascular damage or trauma to the sacroiliac joint. The authors also note that the lateral approach yields significantly longer specimens though the data collected is limited and not specified in the article.

Symington K, Martinez F, Miller LJ, Philbeck T. Examination of 64 consecutive specimens obtained using a powered biopsy device. JVIR 2014;25(3s):S196
This abstract describes the initial experience of one radiology group's use of the powered OnControl system to perform biopsy of focal bone lesions and bone marrow aspiration/biopsy. The authors concluded that the powered system results in higher quality specimens, easier and faster performance of biopsy, a broader spectrum of potential users, and reduced radiation exposure to patients and operators, turning previously inaccessible focal lesions into potential biopsy targets.

This abstract presented at the 2013 American Society of Pediatric Hematology/Oncology Annual meeting describes a randomized study comparing bone marrow biopsy and aspiration procedures performed using the traditional manual device and the powered OnControl device in pediatric patients. The authors concluded that OnControl biopsies were obtained safely, in less time, and in good quality compared to those obtained using traditional manual devices and that the benefits may lead to reductions in anesthesia time and overall cost. This study was sponsored by Vidacare Corporation.

This abstract presented at the 2013 World Conference on Interventional Oncology describes a retrospective review of 64 patients who underwent biopsy procedures performed using the OnControl system by one interventional radiology group. The authors concluded that the device was especially useful for hard bones and difficult to reach lesions, resulted in shorter procedure times with less physician effort, and that use of the device resulted in larger/higher quality specimens, a broader spectrum of potential users, and reduced radiation exposure to patients and clinicians. This study was sponsored by Vidacare Corporation.

Literature review and meta-analysis to determine if the OnControl powered biopsy retrieval system provides for significantly different/improved outcomes for patient pain and sample size. PubMed and Cochrane search done for randomized controlled trials that compared the OC method with manual methods was completed. Authors concluded this analysis demonstrates the OC powered system results in less patient pain and a greater amount of biopsy sample capture with similar adverse events. It also demonstrates the OC system is easy to use.
This pre-clinical study sought to characterize aspiration artifact in the bone marrow to determine the distance from the aspirate site at which artifact would not be observed. Bone marrow aspiration of 3ml, 4ml, and 10ml were performed in the iliac crest with biopsy specimens collected in 0.5 cm intervals from the aspiration site. The iliac crest surrounding the 10 ml aspiration site was excised for evaluation. Results showed that none of the collected specimens demonstrated aspiration artifact. When evaluating the excised bone, it was noted that the artifact symmetrically affected an area of 0.4 cm wide and 1.6 cm deep; a calculated 0.2ml defect. This study was sponsored by Vidacare Corporation.


This abstract describes the 102 patient, multi-center, randomized, controlled trial comparing the powered OnControl system to the standard manual technique. Thirteen device operators from 10 sites participated. Procedure time was significantly less for the powered device (102.1 ± 86.4 seconds) compared to the manual device (203.1 ± 149.5 seconds; p=0.001). One day following the procedure more patients were pain-free from the powered group (67%) than the manual group (33%); sample volume was larger for the powered group (36.8 mm³ ± 21.2) than the manual group (20.4 mm³ ± 9.0; p=0.039). Conduct of this trial was sponsored by Vidacare Corporation.

Berenson JR, Yellin O, Blumenstein B, Philbeck T. Rotary-powered bone marrow access results in shorter procedure time, larger core specimens and less residual pain for patients. J Vasc and Interv Radiol 2011;22(3):S15

Berenson JR, Yellin O, Blumenstein B, Bojanower D, Croopnick J, Aboulafia D, et al. Using a powered bone marrow biopsy system results in shorter procedures, causes less residual pain to adult patients, and yields larger specimens. Diagnostic Pathology 2011;6:23


In this study healthy volunteers were used to comparatively evaluate the powered OnControl system and the standard manual biopsy device. Each subject had a procedures performed with both devices, the order performed was randomized. Results showed samples were obtained in 66.7% of manual procedures and 100% of powered procedures (only single attempts were permitted). Mean time to sample was 86 seconds for the manual group and 47 seconds for the powered; mean second look pain score using 100mm VAS (where higher number indicate greater pain) was 33.3 for the manual and 20.9 for the powered. Pathology evaluation showed a mean sample volume of 11.0 ± 10.8mm³ for the manual and 49.1 ± 21.5 mm³ for the powered. This study was sponsored by Vidacare Corporation.
This article describes a 54 patient randomized controlled trial conducted at 2 academic centers comparing the OnControl powered bone marrow system and the standard manual device in a teaching hospital employing hematologists-in-training. The primary endpoint of the study, the mean length of the marrow biopsy specimens, a surrogate for marrow quality, was determined by a pathologist in a blinded manner. It was concluded that bone marrow procedures performed by hematologists-in-training were significantly faster and superior in quality when performed with the powered device compared to manual devices. These data suggest that the powered device may be considered a new standard of care for adult hematology patients. The powered device also appears to be a superior method for training hematology fellows. This study was sponsored by Vidacare Corporation.


Two large academic centers participated in this prospective study comparing use of the manual bone marrow biopsy device to the powered OnControl bone marrow biopsy system for collection of bone marrow biopsy specimens in adult patients. Fifty patients were enrolled into this study, 25 were assigned to the manual group and 25 were assigned to the powered group. The powered system was superior to the manual device with respect to patient perceived pain from needle insertion and procedural time. Blinded pathological evaluation indicated that specimens collected with the powered system were longer and wider than those collected with the manual device. Authors concluded that the superior size and overall quality of the specimens retrieved using the powered system provide more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures.


This article describes a 54 patient randomized controlled trial conducted at 2 academic centers comparing the OnControl powered bone marrow system and the standard manual device in a teaching hospital employing hematologists-in-training. The primary endpoint of the study, the mean length of the marrow biopsy specimens, a surrogate for marrow quality, was determined by a pathologist in a blinded manner. It was concluded that bone marrow procedures performed by hematologists-in-training were significantly faster and superior in quality when performed with the powered device compared to manual devices. These data suggest that the powered device may be considered a new standard of care for adult hematology patients. The powered device also appears to be a superior method for training hematology fellows. This study was sponsored by Vidacare Corporation.


This article summarizes a preclinical study designed to determine cellular artifact or thermal damage resulting from powered bone marrow sampling and a clinical evaluation of the powered bone marrow sampling device. No cellular artifact or thermal damage was found and the device was found to be safe and easy to use, with significantly shorter procedure time than when using a manual technique.
Hematology/Oncology Bibliography
OnControl Biopsy Aspirate and Bone Marrow

Symington K, Martinez Jr F. Bone marrow procedures move into the 21st century. Oncology NEWS International 2010;19(9)
Brief history of bone marrow procedures and how the IO approach is revolutionizing the field. Discusses use of OnControl. Conduct of this trial was sponsored by Vidacare Corporation.

**YEAR: 2009**

Brenner A, Miller L, Philbeck T, Hacker S. Bone marrow sampling using a rotary powered device yields excellent biopsy specimens in an animal model. Haematologica 2009; 94(s2)
This pre-clinical study evaluated the quality and length of bone marrow core biopsy samples acquired using the powered OnControl device and the standard manual device. Thirty-three samples were collected. An interim pathology report of 13 samples (8 powered; 5 manual) indicated no cellular damage or other significant artifact for either device. The mean length of sample for the powered group was 22.2 ± 10.8mm; the mean length of sample for the manual group was 12.7 ± 6.8mm. This study was sponsored by Vidacare Corporation.

This abstract summarizes a preclinical study designed to determine cellular artifact or thermal damage resulting from powered bone marrow sampling and a clinical evaluation of the powered bone marrow sampling device. No cellular artifact or thermal damage was found and the device was found to be safe and easy to use, with significantly shorter procedure time than when using a manual technique.

**YEAR: 2008**

This article discusses use of the OnControl Aspiration system in 55 patients. Successful aspirate collected in 54 of 55 patients; mean insertion time was 4.9 seconds; mean insertion pain score was 2.5. This study was sponsored by Vidacare Corporation.

This abstract describes an observational study designed to evaluate the ability of a new powered bone marrow aspiration device to obtain bone marrow samples. Mean needle insertion time was significantly lower than previously reported. Findings suggested the device is safe and effective.

**YEAR: 2007**

This abstract describes an observational study designed to evaluate the ability of a new powered bone marrow aspiration device to obtain bone marrow samples. Mean needle insertion time was significantly lower than previously reported. Findings suggested the device is safe and effective.

Islam A. Bone marrow aspiration before bone marrow core biopsy using the same bone marrow biopsy needle: a good or bad practice? J Clin Pathol 2007;60:212-5
This article describes a clinical study of bone marrow aspiration and core biopsy procedures in which single-needle/single-site technique was compared to a double-needle technique. Investigators found the double-needle technique to be superior.
**YEAR: 2014**


This abstract describes use of the powered OnControl Bone Access System with coaxial needles to perform 12 consecutive biopsy procedures of lytic and sclerotic bone lesions. A pathologist was present to provide assessment of the initial specimens and all were of adequate volume/cellularity. One complication of asymptomatic pneumothorax was reported; a precautionary chest tube was placed. The authors concluded the powered biopsy system/co-axial needle set reliably yields multiple large biopsy specimens of adequate cellularity.

**YEAR: 2013**


This prospective study evaluated use of the OnControl Coaxial Biopsy System to perform 25 CT-guided percutaneous bone biopsy procedures. Results were compared to historical manual biopsy procedure data. Data points included specimen adequacy, procedure time, number of procedural CT examinations, radiation dose, and complications. All specimens were obtained on first attempt and deemed adequate for histological diagnosis. The mean specimen length was 2.68 ± 0.68 cm; mean procedure time was 10.5 ± 3.5 minutes which is significantly less than the mean time for manual procedures of 19.4 ± 7.5 minutes. There were no complications. The authors concluded that use of the OnControl system provided a safe, quick and effective means of sampling bone lesions with minimal patient pain.

**YEAR: 2011**

Beall DP. Powered bone access system facilitates faster vertebroplasty procedures. *Skeletal Radiology 2011;40:514-5*

This abstract describes a clinical evaluation of the Vidacare Bone Access System, used to access the vertebral body for delivery of bone cement during vertebroplasty procedures. Clinicians used the device to perform 43 vertebroplasty procedures on 40 patients. All procedures were successful and there were no complications. Conduct of this trial was sponsored by Vidacare Corporation.


This study evaluated the ability of the clinician to successfully insert manual driven needles, hammer driven needles, and power driven needles into simulated bone material of varying depths, to the requested depth. Placement was confirmed by fluoroscopy. Results showed insertion success with manual was 48.5%, with hammer was 69.7% and, with powered was 91%; statistically significant (p<.05). This study was sponsored by Vidacare Corporation.

This abstract presented at the 2013 World Conference on Interventional Oncology describes a retrospective review of 64 patients who underwent biopsy procedures performed using the OnControl system by one interventional radiology group. The authors concluded that the device was especially useful for hard bones and difficult to reach lesions, resulted in shorter procedure times with less physician effort, and that use of the device resulted in larger/higher quality specimens, a broader spectrum of potential users, and reduced radiation exposure to patients and clinicians. This study was sponsored by Vidacare Corporation.


This abstract describes a clinical evaluation of the Vidacare Bone Access System, used to access the vertebral body for delivery of bone cement during vertebroplasty procedures. Clinicians used the device to perform 43 vertebroplasty procedures on 40 patients. All procedures were successful and there were no complications. Conduct of this trial was sponsored by Vidacare Corporation.


Description of steps necessary and common errors to avoid for correct reporting of bone marrow trephine specimens.

Smucker JD, Akhavan S, Furey C. Understanding bony safety zones in the posterior iliac crest; an anatomic study from the Hamann-Todd collection. Spine 2010;35(7):725-9

This article describes the dimensions of the posterior iliac crest region in the human pelvis through analysis of 100 male and female skeletal specimens aged 18 to 80 years. There were no statistically significant differences found between right and left ilia; overall measurements were found to be significantly smaller in women.

Symington K, Martinez Jr F. Bone marrow procedures move into the 21st century. Oncology NEWS International 2010;19(9)

Brief history of bone marrow procedures and how the IO approach is revolutionizing the field. Discusses use of OnControl. Conduct of this trial was sponsored by Vidacare Corporation.


This article provides guidelines for the performance of bone marrow aspiration and trephine biopsies in children. It is intended to be useful for both general pediatricians and pediatric hematologists and oncologists. The departmental procedure and guideline document is included in the publication.


This article provides an overview of approaches for bone biopsy used to minimize potential tumor seeding of surrounding structures. Methods for biopsy of various anatomical locations are included.


This article provides a detailed overview of bone marrow aspiration and biopsy from initial patient visit through processing and reporting.


This article provides an overview of how excellent diagnostic samples, appropriate ancillary testing, and knowledge of clinical context provide the pathologist with ability to distinguish between common reactive and neoplastic processes that involve bone marrow.
This article provides a general overview of the process of iliac crest bone biopsy including the indications, preparation, instrumentation, and potential complications, with a focus on use of the procedure for diagnosis and treatment of renal osteodystrophy.

YEAR: 2007

Parapia LA.  Trepanning or trephanes: a history of bone marrow biopsy.  British Journal of Haematology 2007;139:14-9
This article provides overview of history of bone marrow biopsy procedures; includes descriptions and illustrations of antique and modern biopsy devices.

YEAR: 2006

An overview of indications and methods for bone marrow examination.

YEAR: 2004

This article provides an overview of performing bone marrow aspirate and biopsy examination from indications for bone marrow examination through post procedure care, including possible complications.

YEAR: 2003

An overview of managing haematological cancers.

YEAR: 2001

This article provides a general overview of bone marrow aspiration including, indications and areas of controversy, site and technique, processing, and reporting.

The author provided a general overview of bone marrow trephine biopsy that including, indications and areas of controversy, site and technique, determining adequacy, processing, and reporting.

Trehwitt KG.  Bone marrow aspiration and biopsy: collection and interpretation.  ONF 2001;28(9):1409-17
The authors described the role of oncology nurse practitioners in the performance of bone marrow procedures; and discusses the indications and diagnostic value of the procedures.

YEAR: 1999

In an attempt to develop standardization among clinicians, lymphoma investigators from NCI formed cooperative groups and established a consensus on a standardized set of guidelines for response assessment in adult patients with indolent and aggressive NHL. This document was subsequently reviewed and approved by European lymphoma experts.
YEAR: 1988

This article provides an overview of bone marrow examination.

YEAR: 1984

Koepke JA. Examination of the bone marrow. Laboratory Hematology 1984:1023-50
This article provides an overview of bone marrow examination from indication through processing and final report.

YEAR: 1980

This article (Part 1 of 2) describes bone marrow procedures in general, including techniques, preparation for slides, devices (Jamshidi-Swain), risks, and aftercare.

This article (Part 2 of 2) describes bone marrow procedures in general, including techniques, preparation for slides, devices (Jamshidi-Swain), risks, and aftercare.

YEAR: 1959

Brody JL, Finch SC. Bone marrow needle biopsy. The American Journal of Medical Sciences 1959:140-5
This article describes early 100-patient study of bone marrow procedures. Procedure and technique is described in great detail. With focus on patients undergoing biopsies, investigators concluded that the method is simple, safe and convenient for patients; and that the method will replace surgical procedures for obtaining bone marrow biopsies.
Berenson JR, Yellin O, Blumenstein B, Bojanower D, Croopnick J, Aboulafia D, et al. Using a powered bone marrow biopsy system results in shorter procedures, causes less residual pain to adult patients, and yields larger specimens. Diagnostic Pathology 2011;6:23

This article outlines the 102 patient, multi-center, randomized, controlled trial comparing the powered OnControl system to the standard manual technique in community-based cancer clinics. Thirteen device operators from 10 sites participated. Procedure time was significantly less for the powered device (102.1 ± 86.4 seconds) compared to the manual device (203.1 ± 149.5 seconds; p<0.001). One day following the procedure more patients were pain-free from the powered group (67%) than the manual group (33%); sample volume was larger for the powered group (36.8 mm³ ± 21.2) than the manual group (20.4 mm³ ± 9.0; p=0.039). Conduct of this trial was sponsored by Vidacare Corporation.

Berenson JR, Yellin O, Blumenstein B, Philbeck T. Rotary-powered bone marrow access results in shorter procedure time, larger core specimens and less residual pain for patients. J Vasc and Interv Radiol 2011;22(3):S15

This abstract describes the 102 patient, multi-center, trial comparing the powered OnControl system to the standard manual technique. Results showed procedure time was significantly less, more patients were pain free one day following the procedure, and sample volume was larger for the powered group. This trial was sponsored by Vidacare Corporation.

Abstract (Oral Presentation at 2011 SIR)

In this study healthy volunteers were used to comparatively evaluate the powered OnControl system and the standard manual biopsy device. Each subject had a procedures performed with both devices, the order performed was randomized. Results showed samples were obtained in 66.7% of manual procedures and 100% of powered procedures (only single attempts were permitted). Mean time to sample was 86 seconds for the manual group and 47 seconds for the powered; mean second look pain score using 100mm VAS (where higher number indicate greater pain) was 33.3 for the manual and 20.9 for the powered. Pathology evaluation showed a mean sample volume of 11.0 ± 10.8mm³; for the manual and 49.1 ± 21.5 mm³ for the powered. This study was sponsored by Vidacare Corporation.


doi:10.4081/hr.2011.e21

This article describes a 54 patient randomized controlled trial conducted at 2 academic centers comparing the OnControl powered bone marrow system and the standard manual device in a teaching hospital employing hematologists-in-training. The primary endpoint of the study, the mean length of the marrow biopsy specimens, a surrogate for marrow quality, was determined by a pathologist in a blinded manner. It was concluded that bone marrow procedures performed by hematologists-in-training were significantly faster and superior in quality when performed with the powered device compared to manual devices. These data suggest that the powered device may be considered a new standard of care for adult hematology patients. The powered device also appears to be a superior method for training hematology fellows. This study was sponsored by Vidacare Corporation.


Two large academic centers participated in this prospective randomized study comparing use of the manual bone marrow biopsy device to the powered OnControl bone marrow biopsy system for collection of bone marrow biopsy specimens in adult patients. Fifty patients were enrolled into this study, 25 were assigned to the manual group and 25 were assigned to the powered group. The powered system was superior to the manual device with respect to patient perceived pain from needle insertion and procedural time. Blinded pathological evaluation indicated that specimens collected with the powered system were longer and wider than those collected with the manual device. Authors concluded that the superior size and overall quality of the specimens retrieved using the powered system provide more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures.


A prospective study of 202 patients undergoing bone marrow biopsy and aspiration evaluating anxiety and pain to determine if there are factors that can predict pain score. Procedures were performed using the T-Lok bone marrow biopsy needle. The median pain score was 1.9, on a 0 to 10 scale with 21% of patients experiencing no pain at all; anxiety scored 1.8 and correlated positively with pain. The following similarities were identified among patients who reported higher pain scores: young patient age, poor performance score, prolonged procedures, and patients who were informed about the procedure by the physician. Authors concluded that bone marrow biopsies performed in an optimal setting by experienced hematologists cause only mild pain.

YEAR: 2010


This abstract describes a 102-patient multicenter randomized clinical trial that was designed to determine if a new powered bone marrow sampling device has advantages over traditional manually-inserted needles in terms of decreased pain, decreased procedure time, higher biopsy core capture rate, ease of use, improved sample yield, and higher operator satisfaction scores. Results suggest use of the powered bone marrow biopsy device markedly shortens the procedure time and reduces intermediate-term pain—important considerations for the quality of life for patients undergoing this procedure.

Abstract


A randomized, controlled study conducted at Wake Forest University Comprehensive Cancer Center, evaluating the effect of music played during the bone marrow biopsy procedure on the patient pain and anxiety. Sixty-three (63) subjects were enrolled; Jamshidi was used to perform aspiration and biopsy; there was no significant difference between the music group and the group without music in terms of anxiety or pain. Subjects did however indicate that they highly liked the music and would prefer it on future procedures.
Hematology/Oncology Bibliography

Pain Management

A single center, prospective survey of physicians performing and patients receiving bone marrow examination found pain to be the only procedure related complication. Results suggest that when patients had inadequate information about their procedure, they trended towards an association with unbearable pain.

This abstract describes a 24-subject/48-biopsy specimen study designed to determine if the powered bone-marrow biopsy device has advantages over traditional manual devices in terms of decreased pain, insertion time, and improved sample yield. Results suggest the superior size and overall quality of core specimens delivered by the powered device may provide more material for pathologic evaluation of hematopoietic and oncological disorders. The powered device was significantly faster in obtaining a biopsy than the manual device and its capture rate in obtaining a satisfactory sample was much higher. Use of the powered device significantly decreases overall procedure pain.

This abstract describes a 50-patient study that compared the powered device to the traditional manual technique by relatively assessing pain scores, procedure times, biopsy capture rates, quality of material retrieved, safety and operator satisfaction. Results suggest that the use of a powered bone marrow biopsy device significantly reduces needle insertion pain. Moreover, the superior size and overall quality of core specimens retrieved by the powered device provides more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures. This study was sponsored by Vidacare Corporation.

YEAR: 2009

Prospective study of cancer patients evaluating the characteristics and determinants of procedure-related pain, with bone marrow aspiration/biopsy (BMA) as the procedure. 70% of patients reported moderate to severe pain. Predictors of pain during BMA were identified which may help identify patients in need of complementary interventions to alleviate pain.

A double-blind, randomized crossover study in which 48 patients received bilateral bone marrow biopsy procedures, one side with buffered lidocaine and one side with unbuffered lidocaine. Results showed that using 100 mm VAS (visual analog scale) pain scale, patients reported significantly lower pain scores on the buffered lidocaine side than the unbuffered lidocaine side.

YEAR: 2008

This article discusses use of the OnControl Aspiration system in 55 patients. Successful aspirate collected in 54 of 55 patients; mean insertion time was 4.9 seconds; mean insertion pain score was 2.5. This study was sponsored by Vidacare Corporation.

This abstract describes an observational study designed to evaluate the ability of a new powered bone marrow aspiration device to obtain bone marrow samples. Mean needle insertion time was significantly lower than previously reported. Findings suggested the device is safe and effective.

This study evaluated the efficacy of IV lorazepam, 1mg, as premedication for bone marrow aspiration and biopsy procedures. 138 patients were enrolled, all received local 1% lidocaine and either lorazepam or placebo just before the procedure. Outcome measures included a questionnaire to determine patient perception of the procedure and pain assessments at baseline, just following the procedure, and the next day using a 10cm VAS. Results: IV lorazepam, 1mg, provides no reduction in pain associated with bone marrow aspiration biopsy procedures; more patients receiving the lorazepam reported they were more likely to agree to a second bone marrow procedure.
YEAR: 2007


This abstract describes an observational study designed to evaluate the ability of a new powered bone marrow aspiration device to obtain bone marrow samples. Mean needle insertion time was significantly lower than previously reported. Findings suggested the device is safe and effective.


This letter to the editor describes one hospital’s evaluation of patient discomfort associated with bone marrow procedures and makes a case for use of palliative care consultations in this patient population.

YEAR: 2005


This article describes a study comparing moderate sedation to general anesthesia in the management of frequently performed lumbar puncture or bone marrow aspiration during cancer treatment for children. Study suggests moderate sedation compared favorably with general anesthesia.

YEAR: 2004


This article describes a 263 patient study in which patients receiving bone marrow procedures were evaluated for pain. Substantial pain was reported by 30.4% of patients, but physicians did not realize the pain was felt in more than 50% of the cases. Duration of the procedure was identified as the sole independent predictive factor for patients’ pain intensity.
This abstract describes the initial experience of one radiology group’s use of the powered OnControl system to perform biopsy of focal bone lesions and bone marrow aspiration/biopsy. The authors concluded that the powered system results in higher quality specimens, easier and faster performance of biopsy, a broader spectrum of potential users, and reduced radiation exposure to patients and operators, turning previously inaccessible focal lesions into potential biopsy targets.


This retrospective study evaluated the diagnostic value of MRI guided percutaneous musculoskeletal biopsy and the value of fine needle aspiration biopsy when combined with histologic biopsy in 172 procedures. The authors concluded that MRI guidance produced greater diagnostic accuracy than trepine biopsy and fine needle aspiration biopsy when each are used alone.


This prospective study evaluated use of the OnControl Coaxial Biopsy System to perform 25 CT-guided percutaneous bone biopsy procedures. Results were compared to historical manual biopsy procedure data. Data points included specimen adequacy, procedure time, number of procedural CT examinations, radiation dose, and complications. All specimens were obtained on first attempt and deemed adequate for histological diagnosis. The mean specimen length was 2.68 ± 0.68 cm; mean procedure time was 10.5 ± 3.5 minutes which is significantly less than the mean time for manual procedures of 18.4 ± 7.5 minutes. There were no complications. The authors concluded that use of the OnControl system provided a safe, quick and effective means of sampling bone lesions with minimal patient pain.


This study is a retrospective evaluation of 162 CT-guided bone lesion core needle biopsy procedures performed by two musculoskeletal radiologists using a standard coaxial technique. The objective of this study was to determine if factors could be identified that influence the diagnostic yield of these procedures. The authors concluded that diagnostic yield correlated with lesion type and size; and that lytic lesions and larger lesions produced higher diagnostic yield than sclerotic lesions and lesions < 3cm.


This abstract presented at the 2013 World Conference on Interventional Oncology describes a retrospective review of 64 patients who underwent biopsy procedures performed using the OnControl system by one interventional radiology group. The authors concluded that the device was especially useful for hard bones and difficult to reach lesions, resulted in shorter procedure times with less physician effort, and that use of the device resulted in larger/higher quality specimens, a broader spectrum of potential users, and reduced radiation exposure to patients and clinicians. This study was sponsored by Vidacare Corporation.

Literature review and meta-analysis to determine if the OnControl powered biopsy retrieval system provides for significantly different/improved outcomes for patient pain and sample size. PubMed and Cochrane search done for randomized controlled trials that compared the OC method with manual methods was completed. Authors concluded this analysis demonstrates the OC powered system results in less patient pain and a greater amount of biopsy sample capture with similar adverse events. It also demonstrates the OC system is easy to use.

YEAR: 2012


A pre-clinical study that compared the EZ-IO 15 gauge 25mm needle set and the 13 gauge Jamshidi aspiration/biopsy needle when used to obtain core biopsy specimens in canines.

YEAR: 2011

Berenson JR, Yellin O, Blumenstein B, Bojanower D, Croopnick J, Aboulafia D, et al. Using a powered bone marrow biopsy system results in shorter procedures, causes less residual pain to adult patients, and yields larger specimens. Diagnostic Pathology 2011; 6:23

This article outlines the 102 patient, multi-center, randomized, controlled trial comparing the powered OnControl system to the standard manual technique in community-based cancer clinics. Thirteen device operators from 10 sites participated. Procedure time was significantly less for the powered device (102.1 ± 86.4 seconds) compared to the manual device (203.1 ± 149.5 seconds; p < 0.001). One day following the procedure more patients were pain-free from the powered group (67%) than the manual group (33%); sample volume was larger for the powered group (36.8 mm³ ± 21.2) than the manual group (20.4 mm³ ± 9.0; p = 0.039). Conduct of this trial was sponsored by Vidacare Corporation.

Berenson JR, Yellin O, Blumenstein B, Philbeck T. Rotary-powered bone marrow access results in shorter procedure time, larger core specimens and less residual pain for patients. J Vasc and Interv Radiol 2011; 22(3): S15

This abstract describes the 102 patient, multi-center, trial comparing the powered OnControl system to the standard manual technique. Results showed procedure time was significantly less, more patients were pain free one day following the procedure, and sample volume was larger for the powered group. This trial was sponsored by Vidacare Corporation.

Cherington C, Robetorye R, Anderson EM et al. High quality bone marrow core biopsy and aspiration (BMBX) procedures can be performed by a nurse led team using the OnControl battery powered bone marrow biopsy system. Blood (ASH Annual Meeting Abstracts) 2011; 118: Abstract 4743

In this clinical study, a nurse-led bone marrow biopsy team evaluated the OnControl system for patient care and safety, team satisfaction and specimen quality. Ninety-four (94) bone marrow biopsy procedures were performed and specimen quality was compared to 25 manual specimens obtained by the same team. Results showed the majority of nurses felt in control of depth, were satisfied with ease of aspirate collection, felt improved ergonomics, and preferred OnControl over the manual if given a choice. All but 2 samples collected with OnControl were adequate for evaluation. The authors concluded that in the hands of experienced individuals, OnControl can consistently yield high-quality bone marrow biopsy specimens.


This pre-clinical study sought to characterize aspiration artifact in the bone marrow to determine the distance from the aspirate site at which artifact would not be observed. Bone marrow aspiration of 3ml, 4ml, and 10ml were performed in the iliac crest with biopsy specimens collected in 0.5 cm intervals from the aspiration site. The iliac crest surrounding the 10 ml aspiration site was excised for evaluation. Results showed that none of the collected specimens demonstrated aspiration artifact. When evaluating the excised bone, it was noted that the artifact symmetrically affected an area of 0.4 cm wide and 1.6 cm deep; a calculated 0.2ml defect. This study was sponsored by Vidacare Corporation.


In this study healthy volunteers were used to comparatively evaluate the powered OnControl system and the standard manual biopsy device. Each subject had a procedures performed with both devices, the order performed was randomized. Results showed samples were obtained in 66.7% of manual procedures and 100% of powered procedures (only single attempts were permitted). Mean time to sample was 86 seconds for the manual group and 47 seconds for the powered; mean second look pain score using 100mm VAS (where higher number indicate greater pain) was 33.3 for the manual and 20.9 for the powered. Pathology evaluation showed a mean sample volume of 11.0 ± 10.8mm³; for the manual and 49.1 ± 21.5 mm³ for the powered. This study was sponsored by Vidacare Corporation.
This article evaluates the correlation between bone marrow aspirate and biopsy results in 51 patients with NHL that received both procedures simultaneously. They found that the agreement level was 80% for this patient population, with discrepancies in 20% of cases.

This abstract describes a 24-subject/48-biopsy specimen study designed to determine if the powered bone-marrow biopsy device has advantages over traditional manually-inserted needles in terms of decreased pain, decreased procedure time, higher biopsy core capture rate, ease of use, improved sample yield, and higher operator satisfaction scores. Results suggest use of the powered device markedly shortens the procedure time and reduces intermediate-term pain—important considerations for the quality of life for patients undergoing this procedure.

This article evaluates the correlation between bone marrow aspirate and biopsy results in 51 patients with NHL that received both procedures simultaneously. They found that the agreement level was 80% for this patient population, with discrepancies in 20% of cases evaluated.

This abstract describes a 50-patient study that compared the powered device to the traditional manual technique by relatively assessing pain scores, procedure times, biopsy capture rates, quality of material retrieved, safety and operator satisfaction. Results suggest that the use of a powered bone marrow biopsy device significantly reduces needle insertion pain. Moreover, the superior size and overall quality of core specimens retrieved by the powered device provides more material for pathologic evaluation, thereby increasing diagnostic yield and reducing the need for repeat procedures. This study was sponsored by Vidacare Corporation.


This article summarizes a preclinical study designed to determine cellular artifact or thermal damage resulting from powered bone marrow sampling and a clinical evaluation of the powered bone marrow sampling device. No cellular artifact or thermal damage was found and the device was found to be safe and easy to use, with significantly shorter procedure time than when using a manual technique.

YEAR: 2009

Brenner A, Miller L, Philbeck T, Hacker S. Bone marrow sampling using a rotary powered device yields excellent biopsy specimens in an animal model. Haematologica 2009; 94(s2)

This pre-clinical study evaluated the quality and length of bone marrow core biopsy samples acquired using the powered OnControl device and the standard manual device. Thirty-three samples were collected. An interim pathology report of 13 samples (8 powered; 5 manual) indicated no cellular damage or other significant artifact for either device. The mean length of sample for the powered group was 22.2 ± 10.8mm; the mean length of sample for the manual group was 12.7 ± 6.8mm. This study was sponsored by Vidacare Corporation.

YEAR: 2008


This article provides guidelines for the performance of bone marrow aspiration and trephine biopsies in children. It is intended to be useful for both general pediatricians and pediatric hematologists and oncologists. The departmental procedure and guideline document is included in the publication.


This article provides a detailed overview of bone marrow aspiration and biopsy from initial patient visit through processing and reporting.


This article provides an overview of how excellent diagnostic samples, appropriate ancillary testing, and knowledge of clinical context provide the pathologist with ability to distinguish between common reactive and neoplastic processes that involve bone marrow.


This article provides a general overview of the process of iliac crest bone biopsy including the indications, preparation, instrumentation, and potential complications, with a focus on use of the procedure for diagnosis and treatment of renal osteodystrophy.


The International Council for Standardization in Hematology (ICSH) formed a Working Party for the standardization of bone marrow specimens and reports to prepare a set of guidelines based on preferred best practices. The guidelines were reviewed by an international panel of experts and addresses the procedure from indications for bone marrow examination to reporting results and storage of specimens.


The objective of this study was to evaluate percutaneous core needle biopsy in the diagnosis of musculoskeletal sarcomas. One hundred seventy-three biopsy procedures were performed; in 88.2% of cases, a single percutaneous biopsy was adequate. Additionally, patients undergoing percutaneous biopsy rather than open biopsy had lower rates of major diagnostic errors and complications. The authors concluded that percutaneous needle biopsy was found to be extremely effective and safe for the diagnosis of musculoskeletal masses.

Compares the diagnostic impact of bone marrow cytology in combination with flow cytometry analysis of aspirate smears and bone marrow histology together with immunohistochemical examination of trephine biopsies. Diagnoses between aspirate and biopsy were concordant in 80.5% cases.


This retrospective study evaluated the adequacy of bone marrow aspirate and biopsy samples collected over the course of one year. Of 69 aspirations and 61 biopsies, 42% of aspirations and 32% of biopsies were found to be inadequate. The authors conclude that aspirate and biopsy samples are complementary and give a higher diagnostic yield when both are available for a patient.


Evaluation of the relationship between length of trephine sample and the number of positive cases, in 172 patients with diffuse large cell lymphoma (DLCL). Found that likelihood of positive diagnosis was related to trephine length with no additional benefit noted for bilateral biopsies; examining serial biopsy sections from a single side can provide sufficient diagnostic information.


One hundred ten consecutive primary bone tumor biopsies were performed with CT or fluoroscopy guidance. The authors present the results of the collected biopsies.


The objective of this study was to evaluate the efficacy of bone marrow aspiration as compared to bone marrow biopsy for the purpose of disease diagnosis. Of 420 consecutive cases, aspiration alone was sufficient in making a diagnosis in 372 (88.6%). In the remaining cases bilateral biopsy was required to reach a diagnosis.


This study evaluated use of ultrasound guided Trucut needle biopsy in 63 patients with suspected primary bone tumors. Results showed the diagnostic accuracy of US guided biopsy was 98.4% as compared to surgical biopsy. The authors concluded that on a selected group of patients, ultrasound is a reliable technique of guidance for percutaneous needle biopsy of bone tumors.


In an attempt to develop standardization among clinicians, lymphoma investigators from NCI formed cooperative groups and established a consensus on a standardized set of guidelines for response assessment in adult patients with indolent and aggressive NHL. This document was subsequently reviewed and approved by European lymphoma experts.


This article describes a follow up study to a prior study conducted by the same group of investigators (Reid 1996) evaluating the adequacy of bone marrow biopsy specimens obtained from children. Specimens obtained from 25 different centers were evaluated by a central pathologist and graded for adequacy. Of 605 specimens collected from 150 children with neuroblastoma, 154 specimens (25%) were deemed inadequate. The authors concluded that local initiatives involving active and direct feedback from reporting pathologists should be employed to influence operators.

UK
YEAR: 1996

Evaluation of 822 biopsy specimens for adequacy, collected from children with neuroblastoma over five years, from 25 centers. Found that 17% of biopsy specimens collected were inadequate.

YEAR: 1995

Results of a questionnaire study sent to UK hematologists and oncologists shows that hematologists were significantly more likely to perform routine bone marrow examination in all patients, including newly diagnosed Hodgkin's patients, than oncologists. This suggests that many patients are undergoing an invasive procedure with minimal chance of the results influencing their management.

YEAR: 1992

This article describes an evaluation of 767 trephines performed at The Christie Hospital, Manchester from June 1, 1990- May 31, 1991, to establish criteria for adequacy for bone marrow trephine biopsy specimens and audit institutional performance.

This article examines the role bone marrow aspirate and core biopsy play in diagnosis and regular monitoring of acute myeloblastic leukemia (AML), megakaryoblastic leukaemia and acute myelofibrosis, acute lymphoblastic leukemia (ALL), myelodysplastic syndromes (MDS), and chronic myeloid leukemia (CML). The authors conclude that a core biopsy specimen complements the peripheral blood and marrow aspirate findings in providing additional information for the diagnosis and assessment of prognosis.

YEAR: 1989

The objective of this study was to determine the clinicopathologic correlations and impact on survival of bone marrow and peripheral blood involvement in a series of 172 cases of NHL. Results showed that the overall incidence of blood involvement by lymphoma was 28.5%; blood involvement correlated with splenomegaly, bulky disease, advance clinical stage, and extent of bone marrow infiltration.

Fixed biopsy samples from 125 multiple myeloma patients were reviewed according to morphological and immunohistological criteria. Comparison of the findings of biopsies and aspirates, the aspirate sample lead to an underestimation of the tumor burden in 30% of cases. Abstract

YEAR: 1986

This article discusses the "optimal use" of bone marrow biopsy as a tool in the evaluation of human bone marrow in light of technical advances improving the diagnostic information available from properly prepared bone marrow specimens. Details on diagnosing specific diseases is also included.

YEAR: 1985

In this case report, a 74 year-old man received a bone marrow biopsy for evaluation of non-Hodgkin's lymphoma. Within approximately 1 year of the bone marrow biopsy the patient was found to have developed a 6 cm tumor at the original biopsy site as a result of suspected seeding along the needle tract.
YEAR: 1984
Koepke JA. Examination of the bone marrow. Laboratory Hematology 1984:1023-50
This article provides an overview of bone marrow examination from indication through processing and final report.

YEAR: 1983
This study compared bone biopsy samples taken using a 3mm diameter Jamshidi needle and 5mm diameter electric drill for qualitative and quantitative study of bone histology. Statistical evaluation of the differences and correlations between histomorphometric parameters was performed; results showed that 3mm diameter samples were sufficient for qualitative diagnosis but were not optimum for the quantitative evaluation of cellular parameters of resorption and formation.

YEAR: 1982
A retrospective evaluation of bone marrow biopsies from 678 untreated patients with established malignant NHL to determine the incidence of bone marrow involvement, test independent prognostic relevance of marrow histology, classify bone marrow findings using Lennert's classification, and analyze the mode of spread of malignant lymphoma in marrow to determine staging criteria.

YEAR: 1978
This article describes the relationship between multiple studies performed on bone marrow specimens for the purpose of reaching a correct diagnosis. The authors concluded that utilization of biopsy material by the methods described in the article will provide complete, accurate and reproducible information and minimize the necessity for repeating a biopsy for morphologic diagnosis or ancillary studies.

YEAR: 1976
This abstract describes the review of records at memorial Sloan-Kettering Cancer Center evaluating biopsy and aspirate testing. Supports both aspiration and biopsy are indicated for full evaluation of bone marrow in cancer patients.

YEAR: 1974
Evaluation of 205 simultaneously collected bone marrow biopsy and aspirate specimens from patients with lymphoma, leukemia, and a variety of solid tumors. Specimens were evaluated for adequacy, number of positive biopsies, and disparity between biopsy and aspirate.